MX MISSILE BASING MODE ALTERNATIVES

HEARINGS

BEFORE A

SUBCOMMITTEE OF THE
COMMITTEE ON APPROPRIATIONS
UNITED STATES SENATE

NINETY-SEVENTH CONGRESS

FIRST SESSION

SPECIAL HEARING

Department of Defense

Nondepartmental Witnesses

Printed for the use of the Committee on Appropriations

U.S. GOVERNMENT PRINTING OFFICE
82-990 O WASHINGTON : 1981

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

S181-17

COMMITTEE ON APPROPRIATIONS

SUBCOMMITTEE ON MILITARY CONSTRUCTION

PAUL LAXALT, Nevada, *Chairman*

JAKE GARN, Utah	JIM SASSER, Tennessee
MACK MATTINGLY, Georgia	DANIEL K. INOUYE, Hawaii
MARK O. HATFIELD, Oregon (Ex Officio)	WILLIAM PROXMIRE, Wisconsin (Ex Officio)

PROFESSIONAL STAFF
RICHARD A. PIERCE
MIKE WALKER (Minority)

SUBCOMMITTEE ON DEPARTMENT OF DEFENSE

TED STEVENS, Alaska, *Chairman*

LOWELL P. WEICKER, Connecticut	JOHN C. STENNIS, Mississippi
JAKE GARN, Utah	WILLIAM PROXMIRE, Wisconsin
JAMES A. McCLURE, Idaho	DANIEL K. INOUYE, Hawaii
HARRISON "JACK" SCHMITT, New Mexico	ERNEST F. HOLLINGS, South Carolina
MARK ANDREWS, North Dakota	THOMAS F. EAGLETON, Missouri
ROBERT W. KASTEN, JR., Wisconsin	LAWTON CHILES, Florida
ALFONSE M. D'AMATO, New York	J. BENNETT JOHNSTON, Louisiana
WARREN RUDMAN, New Hampshire	WALTER D. HUDDLESTON, Kentucky
MARK O. HATFIELD, Oregon (Ex Officio)	

Staff
DWIGHT E. DYER, SUSAN E. SHEKMAR, WAYNE A. SCHROEDER, and SEAN O'KEEFE
Minority staff
FREDERICK W. RHODES

CONTENTS

TUESDAY, JUNE 16, 1981

Page

Congressional witnesses 1

Department of Defense:

- Defense Intelligence Agency 5
- Department of the Air Force 24

Congressional witnesses 35

U.S. Arms Control and Disarmament Agency 55

Department of Defense:

- Department of the Air Force 69

THURSDAY, JUNE 18, 1981

Office of Technology Assessment 93

Department of Defense:

- Department of the Air Force 145
- Department of the Army 177

Nondepartmental witnesses 211

FRIDAY, JUNE 19, 1981

Nondepartmental witnesses 233

- Stanford University Linear Accelerator Center 264
- Hydra-Launch for MX Missile 291

MX MISSILE BASING MODE ALTERNATIVES

TUESDAY, JUNE 16, 1981

U.S. SENATE,
SUBCOMMITTEES ON MILITARY CONSTRUCTION
AND DEPARTMENT OF DEFENSE,
Washington, D.C.

The subcommittees met at 10:09 a.m., in room 1223, Everett McKinley Dirksen Senate Office Building, Hon. Paul Laxalt (chairman, Subcommittee on Military Construction) presiding.

Present: Senators Laxalt, Stevens, Garn, Schmitt, Rudman, Huddleston, and Mattingly; also present: Senator Hatch.

CONGRESSIONAL WITNESSES

HEARING PROCEDURE

MOTION TO ADJOURN INTO EXECUTIVE SESSION

Senator LAXALT. The subcommittees will come to order.

Before we go any further, I would like a motion to be made to close the hearings. We are about to go into classified areas regarding national security matters as they apply to the basing mode for the MX missile.

It is our intention to publish these hearings in as much detail as possible, but we must wait to see what areas can and cannot be released.

Therefore, I move that the subcommittees go into executive session for the MX basing mode alternative hearings.

Is there a second?

Senator GARN. I second the motion.

Senator LAXALT. All those in favor.

[A chorus of ayes.]

Senator LAXALT. Without objection, so ordered.

PREPARED STATEMENTS

I have other statements by way of an opening statement, but rather than take the time of the committee, I ask leave and ask unanimous consent that it be filed at the appropriate time and place.

Senator GARN. I would make the same request that my statement be placed in the record.

Senator LAXALT. Senator Schmitt?

Senator SCHMITT. Mr. Chairman, I will be presenting testimony this afternoon.

Senator LAXALT. Senator Rudman?

Senator RUDMAN. No comment at this time, Mr. Chairman.

[The prepared statements of Senators Laxalt and Garn follow:]

PREPARED STATEMENT OF SENATOR PAUL LAXALT

HEARINGS ON MX BASING MODE ALTERNATIVES

Today we will begin hearings on the basing mode for the MX missile. I am pleased that the distinguished Chairman of the Defense Subcommittee, Senator Stevens, has agreed to hold these as joint hearings to make all of the information we are about to receive available to our colleagues. Our two subcommittees will be asked to consider nearly $3 billion for the MX in our fiscal year 1982 budget considerations. While this is a relatively small amount when focused against the total defense requirements, it is but the beginning of what has been described as the largest public works project in the history of the world.

Last year, the Military Construction Subcommittee heard from various witnesses on the basing mode for the MX. However, the Reagan administration is presently taking a hard look at the Air Force proposal to deploy the system. The Congress has continued to question the basing mode, and therefore, our hearings this year will focus on the basic threat assumptions as they apply to the MX deployment.

Obviously, the proposed deployment in Nevada is of great concern to me, but I also look at this new weapons system from a national security viewpoint. In any event, these hearings are being held to provide our members with the in-depth data which I believe is necessary for us to make an intelligent decision on the MX basing mode.

We will begin this morning with a threat assessment briefing from the Defense Intelligence Agency. We want to welcome Mr. James R. Miller, Chief of DIA's Weapons and Systems Division who will give the briefing. Following Mr. Miller, we will hear from Lt. Gen. Kelly Burke, the Deputy Chief of Staff for Research, Development and Acquisition at Headquarters, Air Force. The Air Force will continue our progrm with the MX system resiliency to threat briefing and a system overview.

I want to welcome all of our witnesses to what I hope will be some most interesting and informative hearings.

At this point, I would ask if any of my colleagues have statements they would like to make and then we will begin with Mr. Miller.

PREPARED STATEMENT OF SENATOR JAKE GARN

Good Morning, Mr. Chairman. I have several brief introductory remarks I would like to make at this time. First, I would like to thank you for joining with me in initiating these joint Defense and Military-Construction Subcommittee hearings to review the issue of MX basing. We have come a long way since this subcommittee held similar hearings on this subject last May. In fact, a number of things have changed since that time.

The Carter administration abandoned its original racetrack basing proposal in favor of a linear, loading-dock system. That system, although somewhat less obtrusive than the racetrack proposal, remained an enormous undertaking. The potential for severe and long-lasting socio-economic and environmental impacts of MX deployment on our two States of Utah and Nevada were only hinted at in the Air Force's Draft Environmental Impact Statement. Moreover, serious questions have been raised about the ultimate survivability of this particular basing mode, and hence its military effectiveness has been placed in doubt.

In this context, the election of a new President last November was a particularly important development. President Reagan came into office faced with the difficult challenges of revitalizing both our domestic economy and our Nation's armed forces. The MX basing decision strikes at the very heart of this second challenge and has serious implications for the first. Therefore, President Reagan committed his administration to a thorough review of this entire question. In this regard, Secretary of Defense Weinberger's decision to appoint an independent MX basing review board, the so-called Townes panel, was applauded by the Congress and the citizens of Utah and Nevada.

The work of the Townes panel is presently nearing completion. Its report to Secretary Weinberger is due by the 1st of July, and the President is expected to make his recommendation to the Congress shortly thereafter. Thus, these hearings come at a most critical time in the decisionmaking process. These hearings will allow the Senate to reserve for itself an important role in helping to determine the final shape of the President's recommendation, as well as reviewing that decision once it has been made.

KEY ASPECTS OF MX MISSILE BASING QUESTION

We have before us these next several days an opportunity to discuss in great detail several key aspects of the MX basing dilemma, including:

the growth of the Soviet threat and its likely dimensions in the years to come;

the desirability for the United States to preserve a vigorous Triad of strategic nuclear forces;

the potential contribution of an ABM system in resolving the MX basing issue;

the relative merits and shortcomings of the Air Force's preferred basing alternative, as well as those of various sea-based options;

and finally, the likely arms control implications of any decisions which might be made with respect to MX basing.

The questions of how and where to base the MX have personally been very difficult ones. I have been convinced for several years now of the need to deploy this missile system in a survivable basing mode. I remain committed to that conviction. Yet, I have never been convinced that the MX basing proposal of the previous administration was the optimal choice.

My concerns have not been merely parochial. Certainly, I cannot divorce myself from the State where I was born and raised nor the people with whom I have associated all my life. I do not intend to argue, however, that this association or the unique nature of the life style of the people of Utah make us eligible for special treatment. No State or community has this right on questions of national security. We are a united people, and our fortunes as a nation cannot and must not be made divisible. To paraphrase the words of John Donne, "No community is an island, entire of itself, each is part of the one same nation sharing a common destiny."

In this light, I would note that long before the details of the Carter administration's basing proposal began to stir serious concerns in my State, I expressed personal reservations about the wisdom of the proposal. I did so because of the very obvious concessions the racetrack proposal made to arms control considerations—concessions that tended to increase the total cost of the system, both in terms of the drain it would impose on the defense budget and the vast socio-economic and environmental impact it would have on the people and land of Utah and Nevada, while restricting its military effectiveness.

Moreover, my involvement in the Minuteman vulnerability issue nearly 4 years ago, led me to consult with Air Force officials, particularly the Chief of Staff at the time, Gen. Tom Stafford, to determine what the best approach to MX basing might be. Those discussions focused on the merits of hardened vertical silos in a multiple protective structure (MPS) mode as the best way to resolve this strategic problem. At no time was there ever any attempt made to argue the case for a relatively soft, 600 PSI, horizontal shelter as the optimal approach for MX basing. So, my preference for a land-based system involving vertical silos is one of long standing.

MAD THEORY

My interest in strategic defensive systems, particularly ABM and space-based lasers, derives from my general dissatisfaction with the mutual assured destruction (MAD) theory. This theory, itself, holds that defending oneself against a nuclear attack is somehow destabilizing. In my mind, there have been few, if any, more dangerous concepts in the entire realm of U.S. defense policy. For more than two decades, this country has operated largely under the assumption that we would launch a nuclear attack against an adversary only after riding out a pre-emptive first strike. I am not going to argue here the case for a launch-on-warning strategy as our Nation's first line of defense, given the inadequacies of our present early warning systems. Rather, I wish to protest the kind of retaliatory strategy that takes no account of defensive systems designed to protect our strategic forces of our citizenry. Certainly, this is the stuff of which true madness is made.

Mr. Chairman, the United States has struggled with the issues of MM vulnerability and MX basing for several years. We stand at a critical juncture in resolving these questions. We must demonstrate to our allies and adversaries the determination to preserve a balance of forces while seeking their control through negotiated agreements. We must strive to accomplish these ends without imperiling the renewed consensus that exists in this country for a stronger defensive posture.

With these thoughts in mind, let me close by saying once again that I appreciate this opportunity to participate in these deliberations, the outcome of which may help shape the course of our country's defenses into the next century.

INTRODUCTION OF WITNESS

Senator LAXALT. We will begin this morning with a threat assessment briefing from DIA.

We want to welcome Mr. James R. Miller, Chief of DIA's Weapons and Systems Division who will give the briefing.

Following Mr. Miller, we will hear from Lt. Gen. Kelly Burke, Deputy Chief of Staff for Research, Development and Acquisition at Headquarters, United States Air Force. The Air Force will continue our program with the MX systems resiliency, the threat briefing, and a system overview.

I want to welcome all of our witnesses to what I hope will be some interesting and informative hearings.

Senator Stevens, did you have an opening statement. We thought we would move ahead. What we have done essentially is just file our statements.

Senator STEVENS. No, sir.

I am sorry I am here a little late.

Good morning.

Senator LAXALT. No problem.

All right, then, we will proceed. Mr. Miller.

DEPARTMENT OF DEFENSE

DEFENSE INTELLIGENCE AGENCY

STATEMENT OF MR. JAMES R. MILLER, CHIEF, WEAPONS AND SYSTEMS DIVISION, DEFENSE INTELLIGENCE AGENCY

DIA ASSESSMENT OF SOVIET STRATEGIC OFFENSIVE THREAT

Mr. **MILLER**. Good morning.

Today's briefing will cover the Defense Intelligence Agency assessment for the Soviet strategic offensive threat that could be brought to bear against the proposed MX multiple protective shelter system.

The briefing will cover the current forces and those projected for the 1990's when the MX-MPS system would become operational.

While the Soviets have not maintained a balanced Triad, they do in effect have a Triad which is heavily oriented toward ICBM's. The briefing has been constructed to look at each leg of the Triad to determine if it presents a threat to the proposed MX-MPS system. During the course of the briefing I will describe various Soviet military threats as assessed by the Intelligence Community. These threats include potential Soviet responses to different conditions of strategic arms limitations.

[CLERK'S NOTE.—Due to the sensitive nature of their content, all charts and illustrations referred to in the testimony have been withheld from publication.]

TRIAD AERODYNAMIC WEAPONS SYSTEM

Mr. **MILLER**. First, let's look at the aerodynamic weapons system leg of the Triad.

Shown here are the capabilities of the current Soviet bomber force that could be targeted against the United States. The bomber free-fall weapons have an acceptable kill probability against upgraded Minuteman silos. However, this is of marginal utility when you consider the number of weapons carried and the penetration times required.

Senator **SCHMITT**. What does that mean, acceptable kill?

Is that part of your jargon?

Mr. **MILLER**. I will get into that in some detail.

Senator **SCHMITT**. Acceptable to whom, to them, to us?

Mr. **MILLER**. Acceptable to the Soviets.

This is the current inventory of the Soviet long-range aviation bombers capable of reaching the United States. It is a small force composed primarily of older aircraft. The Bear A and Bison are free-fall bombers, while the Bear B and C can carry a fuselage mounted AS-3 missile. Backfire carriers [deleted].

The Intelligence Community is projecting several new bombers or air launched cruise missiles that could become operational during the 1980's. This graphic displays the performance characteristics of these aircraft and their associated cruise missiles [graphic deleted]. The improved accuracy, when applied against the projected hardness of the MX-MPS shelters, provides for an excellent kill probability.

SINGLE SHOT KILL PROBABILITY AND DAMAGE EXPECTANCY

Let me digress for a moment to discuss two terms that I will be using extensively during the briefing. These are single shot kill probability and damage expectancy. These are terms used by the military planners both in this country and the Soviet Union to describe the percentage of point targets expected to be rendered incapable of performing their assigned missions after an attack. Single shot kill probability is the probability of an arriving weapon destroying a target. The calculation of this term involves the elements of system accuracy, warhead yield, and target hardness. Kill probability is then multiplied by the system reliability to determine damage expectancy. Damage expectancy can also be used to determine the percentage of kill when more than one weapon is used against a single target.

This is the intelligence community's best assessment of the projected long range air threat for 1990. The estimate covers the conditions of both SALT II and no SALT in force.

ELEMENTS IN AERODYNAMIC WEAPONS

There are several important elements to consider with aerodynamic weapons. For a first strike there is the problem of planning for the major differences between aerodynamic weapons and ballistic missile flight times. This time phasing, along with the limited number of deliverable weapons available on aerodynamic platforms, severely limits the feasibility of using these weapons in a first strike mode, and tends to downgrade the aerodynamic threat to MX-MPS.

This chart lists some of the more significant problems facing the Soviet planner if long range aviation is targeted against MX-MPS [chart deleted]. There is only marginal tanker support deployed, and it does not appear to be adequate for the mission. As a result both Bison and Backfire would be forced to fly one-way missions. In addition, they would be restricted primarily to high altitude penetration of U.S. air space.

There are, however, cruise missile R. & D. programs in progress which may enhance their aerodynamic threat in the 1990's. The Soviets are probably developing [deleted].

SOVIET AIR THREAT TO MX-MPS

Although the intended targets for these missiles have not been determined, we do not believe they pose a first strike threat to the MX-MPS system. The Soviets may plan to use these missiles against peripheral targets in Europe, China, and the Middle East, or in second or third strikes against the U.S. ICBM silos or industrial targets.

In summary, the current and projected Soviet aerodynamic forces do not appear to pose a significant threat to the proposed MX-MPS deployment. The limitations posed by the number of deliverable warheads, the timing problems and the long flight times would seem to obviate a first strike role. Rather, aerodynamic weapons appear to be much better directed to non-time-urgent targets or to second strike, cleanup type of operations.

SLBM/SSBN FORCE

Let's now turn our attention to the ocean-based leg of the triad, the SLBM/SSBN force. Here again we have a limited current force without a hard target capability. However, the Soviets are placing a major effort on their SLBM/SSBN force, and we expect to see significant improvements over the next decade.

SOVIET SUBMARINE-LAUNCHED BALLISTIC MISSILE FORCE

The Soviet submarine-launched ballistic missile force includes the short range SS-N-6 and the long range SS-N-8 and SS-N-18. The SS-N-18 is the only multiple independently targetable reentry vehicles, or MIRV's SLBM currently in the inventory. All have accuracies of [deleted] and therefore [deleted] a threat to hardened targets.

The total number of currently deployed Soviet Yankee I and Delta class submarines is 62, with 920 launch tubes.

The Yankee class submarines with the short range SS-N-6 missiles conduct regular patrol [deleted] Delta submarines with either the SS-N-8 or SS-N-18 conduct patrols [deleted].

While the SS-N-6 SLBM cannot cover all Conus targets [deleted] the SS-N-8 and SS-N-18 can cover all Conus targets. The number of submarines on patrol is usually small, about [deleted] split [deleted] between the Atlantic and Pacific patrol areas. While this only represents [deleted] percent of the SSBN fleet, [deleted].

SOVIET SS-NX-20 SYSTEM

The Soviets have a number of new and modified SLBM's in various stages of development. The SS-NX-20 entered flight test in 1980. [Deleted.] All are expected to enter the inventory [deleted]. The SS-NX-20 is the first [deleted]. The program has had [deleted] however, the system is expected to reach an operational capability in [deleted].

The SS-NX-20 will be carried on the large Typhoon submarines, the first of which was launched in September of 1980. This is the world's largest submarine, displacing an estimated [deleted] tons. [Deleted.] Unlike other ballistic missile submarines, the 20 launch tubes of the Typhoon are located forward of the sail.

The incorporation of the SS-NX-20 into the SLBM force will significantly increase the number of deliverable warheads in the next decade.

SLBM accuracies through the 1980's are projected to be improved [deleted] over currently deployed systems. If the Soviets are successful in achieving the projected improvements, SLBM's could become effective against [deleted].

There is, however, a difference between DIA and CIA in the interpretation of available data. This chart displays the differences [chart deleted].

THREAT TO MX-MPS SYSTEM

The threat to the MX-MPS caused by the follow-on SLBM systems will depend not only on the accuracy of these weapons, but also on their yield, reliability and availability. The throw weight projected for the NX-20 modification, the largest of the follow-on systems, is [deleted] kilograms. If fractionation is designed with a 0.9 probability of kill requirement, the Soviets could have [deleted] MIRV's, each with a [deleted] weapon for this particular SLBM. The current projection of Typhoon submarines, each with [deleted] launch tubes, equates to [deleted] deliverable warheads. Although not negligible, this total does not significantly add to the Soviet ICBM threat.

In summary, the current SLBM leg of the Triad can be discounted as a threat to the MX-MPS deployment. Although in the 1990's improvements in system accuracy will increase the threat potential, there are not a sufficient number of improved weapons projected to create a major threat to the proposed MX-MPS deployment.

STRENGTH OF SOVIET ICBM FORCE

By far the strongest leg of the Soviet Triad is the Soviet ICBM force. Let's now turn our attention to that leg.

The Soviet ICBM force is currently deployed in hardened silos widely dispersed throughout the European U.S.S.R. and along the Trans-Siberian Railroad.

There are five different ICBM's deployed, each with several modifications. These include currently [deleted] operational launchers which can deliver a total of [deleted] warheads. [Deleted.] When the current modernization program is completed [deleted] the Soviets will have a total of [deleted] deliverable ICBM warheads on line.

Let's examine the capabilities of the ICBM's currently being deployed by the Soviets. The SS-11 and SS-13 are older missiles which do not have a MIRV or hard target capability. The SS-17, SS-18, and SS-19 were all initially deployed in 1974 and are now being replaced by modifications of the original missiles. They were all developed and tested with both single RV and MIRV'ed payloads.

MISSILE SYSTEM ACCURACY VALUES

The accuracy values shown are also indicative of the roles of the individual missiles. The SS-11 and SS-13 [deleted] are suitable only for soft targets. Although the SS-17 accuracy is somewhat better, it is not accurate enough to be effective against Minuteman targets [deleted]. The SS-18 Mod 4 and SS-19 Mod 3 are credited with [deleted] probabilities of kill against hardened targets such as missile silos and shelters.

SOVIET ICBM'S DELIVERABLE WARHEADS

This graphic classifies the current ICBM deliverable warheads according to targeting capabilities [graphic deleted]. The SS-18 Mod 4 and SS-19 Mod 3 reentry vehicles are classed as [deleted] MIRVs. The single RV versions of the SS-17, SS-18, and SS-19 ICBM's are classed as large, accurate singles. The remaining RV's are considered most suitable for soft targets. The number of RV's shown in the projected column are for the near future, [deleted] at which time the current modernization program will be completed.

This is the effectiveness of the current Soviet ICBM's against upgraded Minuteman silos at [deleted]. The chart shows that the SS-17 would not have a satisfactory effectiveness, from the Soviet point of view, against Minuteman silos, even if two RV's are used against each silo [chart deleted]. For the SS-18 Mod 4 and the SS-19 Mod 3, the damage expectancy for single RV targets [deleted] with two RV's per silo, the damage expectancy is considered [deleted]. As a result, if 2,000 SS-18 and SS-19 RV's are targeted against 1,000 Minuteman silos, theoretically [deleted] Minutemen could not be launched. This, of course, is predicated on a nonresponse attack by the Soviets. In other words, we ride out the initial attack and then attempt to launch our force.

Senator LAXALT. Could you restate that again, please?

That is [deleted] SS-18's and SS-19's.

Mr. MILLER. If [deleted] SS-18 and SS-19 RV's——

Senator LAXALT. Against 1,000 Minutemen.

Mr. MILLER [continuing]. Go against 1,000 Minutemen, theoretically [deleted] of the Minutemen would be all that would be remaining. [Deleted] could not be launched. And again, that is predicated on a nonresponsive attack, we sit here and ride it out.

Targeting [deleted] against a single small target such as an ICBM silo presents major problems to the planner and designer.

Senator LAXALT. May I back up again?

Mr. MILLER. Surely.

SOVIET MISSILE CAPABILITY AGAINST MINUTEMAN

Senator LAXALT. How clear is the evidence of that kind of capability on Minuteman?

Mr. MILLER. We are using the Minuteman silo hardness numbers as given to us by the Air Force. The 2,200 pounds per square inch hardness is for an upgraded Minuteman silo, and that was provided to the intelligence community by the Air Force. We didn't do that assessment ourselves.

The ICBM accuracy number is the most important number in the damage expectancy calculation. [Deleted.]

Senator LAXALT. And how is that determined?

Mr. MILLER. Accuracy is determined by a major integration of all the available data that we have, [deleted].

We also use other sources of information which [deleted].

Senator LAXALT. And at what point will they have that capability?

Mr. MILLER. They have that capability now.

Senator LAXALT. Now?

Mr. MILLER. Yes, sir.

The systems, the SS–18 Mod 4 which is currently being deployed. There are some [deleted] of the 308 SS–18's that have been converted to SS–18 Mod 4's at this point. It is expected that [deleted] will be converted by the end of [deleted].

The SS–19, there are some 300 deployed at the present time. We expect when the deployment is completed at the [deleted] there will be some [deleted].

Senator **Laxalt**. Dee?

DEPLOYMENT OF SOVIET MISSILE SYSTEMS

Senator **Huddleston**. I just want to suggest that the capability for accomplishing what you have just outlined, that is 80 percent destruction, is [deleted] not today.

Senator **Miller**. Not today.

Senator **Huddleston**. They have the weapons but they don't have them deployed.

Mr. **Miller**. I don't have a full deployment at this time. I still have in the SS–18 force a mix of SS–18 Mod 1, 2, 3, and 4's. And while the SS–18 Mod 1 and 3 are single RV weapons with a very large yield, [deleted] they probably would not be used for that purpose because you are only getting a single RV per booster. The SS–18 Mod 2 which is currently being rapidly replaced by the Mod 4 has around a [deleted] meter CEP, [deleted].

VULNERABILITY OF MINUTEMAN

Senator **Laxalt**. At what point did we get sufficient information to indicate that Minuteman had this kind of vulnerability, 1976, 1977? At what point did this all occur?

Mr. **Miller**. The National Intelligence Estimate for Strategic Forces started covering this potential in 1977.

Senator **Laxalt**. Was there some significant breakthrough in their technology that permitted this kind of capability?

Mr. **Miller**. As I said, the SS–18 Mod 2 [deleted] they started flying a modification of the Mod 2 which we designated the Mod 4 in [deleted]. We [deleted] and therefore had the much better potential capability.

The SS–19 Mod 1 which was the forerunner to the Mod 3 MIRV had an accuracy of about [deleted] meters. They then installed the [deleted].

Now, at that time we could not say specifically that it was 245 meters. It took us about [deleted] to come up with that estimate. [deleted.]

General **Burke**. As I recall, as late as 1978, a large segment of the technical community that was making these evaluations held the opinion that they could not get this level of accuracy until the next generation of missiles. The [deleted] data that was [deleted] demonstrated that that just wasn't so, that they had, in fact, achieved it and demonstrated it with the SS–18 and SS–19 in particular, and the National Intelligence Estimate that was published in January of 1979 made a very dramatic advance of that point, at which time the Soviets at least mathematically destroyed [deleted] percent. They moved it up [deleted] in effect, overnight.

Mr. **Miller**. The Soviets kind of leapfrogged us.

EFFECT OF KILL PROBABILITY

Senator LAXALT. What is the effect of the [deleted] percent kill probability in [deleted] in terms of our response? That leaves us [deleted].

Mr. MILLER. Well, the estimate is that if we sit and ride out a first strike by the Soviets we would probably have no more than [deleted] weapons, boosters, that we could launch.

Senator LAXALT. Under what circumstances would we ride out that kind of first strike?

Mr. MILLER. I can't answer that, sir. That is U.S.——

Senator HUDDLESTON. You are still just talking about the land based, the Minuteman. You are not talking about what is left on the submarines.

Mr. MILLER. Absolutely. I am discussing only Minuteman.

Senator GARN. Let me make another point, Dee.

VULNERABILITY OF MINUTEMAN III

In 1977 and 1978, before you started to get this empirical data, a long time before that we were talking about the growing vulnerability of Minuteman III, at least in answer to your question, back in 1975 on the Armed Services Committee the first year I was here.

Mr. MILLER. Yes, sir, I gave a briefing to that effect at that time.

Senator GARN. You didn't have the numbers.

Mr. MILLER. No, sir.

Senator GARN. But I didn't want to leave the impression that suddenly we discovered that Minuteman was growing vulnerable in 1977. It was before that. In fact, it was before I got here. That's why MX was under consideration and why some of us tried so hard to get a decision on MX, not the basing mode but on going ahead with the missile prior to that and encouraging President Ford to do it in the summer of 1976.

Mr. MILLER. We were projecting at that time that the Soviets would reach these accuracy capabilities by the mid-1980's. They jumped ahead. That is the whole thing.

What the Soviets have done in the past, if you go back through the trends in the history, is if they intend to make significant changes to a missile, especially in accuracy, they usually [deleted].

In this case [deleted] they put many of the improvements into both the SS-17, SS-18, and SS-19 as modifications [deleted] and what we are seeing right now in the SS-17, SS-18, and SS-19, we believe, is what we were [deleted].

We saw the [deleted] and it kind of surprised us.

Senator LAXALT. Let me ask another threshold question, if I may, considering this affects only ICBM's. It doesn't affect the other legs of the Triad.

SOVIET FIRST STRIKE AGAINST MINUTEMAN

How probable is it that they would initiate a first strike against the Minuteman?

Mr. MILLER. That is the $64 question.

Senator LAXALT. I understand that, but I would like an answer.

Mr. MILLER. Soviet writings, classified and unclassified, indicate they feel that they have the capability to accomplish a first strike against this country. They feel that they [deleted].

Now, of course, if you are in a period of crisis, then your first strike is a slightly different situation because now all forces are at the ready. When I talk first strike here, I am basically talking cold, out of the blue type of strike where the enemy is caught and doesn't respond. I would expect under a full-scale crisis situation the probability would be that we would attempt to get weapons off. But I am speaking out of turn again, as far as U.S. policy and procedures are concerned.

I feel that the Soviets would seriously consider a first strike even though they would have to [deleted] if they can take out enough of [deleted] they would seriously consider this, from all of the indications.

Senator SCHMITT. Isn't the more probable scenario the threat of a first strike and on international confrontation of some kind—they raise the threat and we have to deal with the realities of that threat?

Mr. MILLER. Oh, absolutely, yes, sir.

Senator SCHMITT. And also the threat not only of a first strike, but what that capability is for their second strike against our targets of value?

Mr. MILLER. Yes, sir. They will have, according to our best estimate, [deleted] which many people will term a [deleted] where you have the opportunity or the capability of [deleted].

CREDIBILITY OF SOVIET STRIKE THREAT

Senator SCHMITT. The reason I ask that is that these discussions are sort of academic in order to determine what your response is going to be, but in the real world the more likely scenario is their threat. Do we believe it is credible? And what are we going to do in terms of our foreign policy response in view of a credible threat that in [deleted].

Mr. MILLER. Yes, sir.

Senator HUDDLESTON. Well, it seems to me that you can eliminate that possibility by just announcing to the whole world that the silos will be empty when the first strike arrives, then there is not much percentage in their——

Senator SCHMITT. Well, that is an ace in the hole if you want to reduce your vulnerability gap, but you have got to be sure that you have an [deleted].

Senator LAXALT. Please continue.

TARGETING AGAINST ICBM SILOS

Mr. MILLER. Targeting [deleted] against a single small target such as an ICBM silo presents major problems to the designer and planner. The problem is to [deleted].

On the basis of available data, the Intelligence Community believes that the Soviet ICBM [deleted].

Studies have been undertaken to determine Soviet problems which might arise from the requirement to place a large number of RV's in a relatively small area during a short time period which would be required in a situation such as the MPS deployment. The fratricide avoidance timing requirements when coupled with the geographic relationship of the Soviet ICBM launchers and the MPS targets [deleted].

TRENDS IN ICBM IMPROVEMENT

Since the threat to the proposed MX-MPS deployment will be posed by the future, not the current, Soviet ICBM force, it is important that we discuss Intelligence Community projections. Available intelligence indicates that certain trends in ICBM improvement will continue. We expect that the Soviets will continue to improve the accuracy of their ICBM force through the development of better guidance and control systems and new RV's. As the system accuracy improves, payloads can be further fractionated, thereby increasing the number of RV's. We also expect improvements in [deleted] which will improve the [deleted]. This combination of improvements could significantly improve the ability of their ICBM force to attack hard targets. In addition, as a hedge against the potential vulnerability of their hardened silos, we expect to see the Soviets actively pursue [deleted].

PROJECTION OF NEW AND MODIFIED ICBM'S

This chart contains the community projection of new and modified ICBM's which are forecast to become operational over the next 10 years [chart deleted]. While the list [deleted] most of the systems listed will be modifications of or follow-ons to currently existing systems. The Soviets have, at this point, [deleted] and will probably concentrate on product improvements over the next decade.

The exceptions to this are the [deleted] which are expected to enter flight tests in [deleted]. The [deleted] which has been in the [deleted] is expected to be a [deleted] and will probably [deleted]. The [deleted] will also be [deleted]. The [deleted] is believed to be an [deleted] which was a [deleted]. It will probably be a [deleted].

ICBM ACCURACY

One of the more critical ICBM performance parameters to consider when developing threat assessments is that of accuracy. It is important for two reasons: First, it is most affected by technological capabilities, and second, damage expectancy is most sensitive to changes in accuracy, except when the kill probability is extremely high. This chart displays Soviet improvements in ICBM accuracy over the past decade, and the improvement expected over the next 10 years [chart deleted].

Community projections of ICBM accuracy over the next decade call for about [deleted] meters in the mid-1980's, and [deleted], meters by the late 1980's. Also shown are the community uncertainty intervals for these estimates.

Now, let me digress from my script for just a moment to talk about these numbers. The [deleted] meter number I discussed in some detail previously, so I don't need to go into that. The mid-1980's and late 1980 numbers, [deleted] are based on [deleted] but we feel that it is well within the Soviet capabilities to get there over the next 10 years.

Senator SCHMITT. Does that include any [deleted].

Mr. MILLER. No, sir, it does not.

Do you mean [deleted]?

Senator SCHMITT. Yes; whatever.

Mr. MILLER. These do not. They are [deleted]. We feel that it would not be until the [deleted]. before the Soviets could come up with a terminal homer system although they are [deleted] but we don't see any applications with [deleted] and it would probably be [deleted] before they would have this capability. At that point we would say a CEP potential of between [deleted] would be available to them.

CEP POTENTIAL

Senator LAXALT. Will you translate the CEP's for me?

The [deleted] does that give them the capability to [deleted].

Mr. MILLER. Yes, sir, those are the PK numbers that I gave you previously.

Senator LAXALT. What is the [deleted] increased accuracy, then?

Mr. MILLER. I will get to that on about the next slide.

Senator LAXALT. OK.

Mr. MILLER. It shows a significant change in capabilities.

The effect of accuracy improvements will be substantial, even if no other upgrades are made. Shown here is the impact of accuracy-only improvements on the effectiveness of the Soviet ICBM force. The two hardened targets considered are [deleted]. The single-shot kill probability and damage expectancy values for the mid-1980's—that is with the [deleted] meter CEP—are based on current SS–18 and SS–19 [deleted] and the mid-1980's accuracy.

The values for 1990 are based on the [deleted] but improved [deleted] and late 1980's accuracy. The point to be made is that the current Soviet force, with projected improvements in accuracy, will have a substantial [deleted] kill potential against either type of target.

As you remember, in here we are talking about [deleted] damage expectancy. When you get to the mid-1980's you are talking about a [deleted] damage expectancy for [deleted] and even [deleted]. You do have a slightly smaller damage expectancy, but by the end of the 1980's, you will see with the [deleted] meter CEP, the [deleted].

There is, however, an [deleted] to cope with a widespread MPS deployment.

THROW WEIGHTS FOR SOVIET ICBM'S

The Soviets, however, have a major advantage in the form of large throw weights for their ICBM's. As missile accuracy improves and warhead yield-to-weight ratios increase, the given damage expectancy can be achieved with a smaller warhead, which in turn allows a smaller RV. This development, in turn, makes it possible for an existing missile booster to deliver a greater number of smaller reentry vehicles, each capable of the original effectiveness against the point target. If, in addition, the propulsion system is improved to deliver more payload weight, even more RV's can be delivered.

Studies have been undertaken to determine the fractionation potential of the [deleted] SS-18 and SS-19 ICBM's. Using currently available RV's and a new configuration for the postboost vehicle, it is estimated that the SS-18 booster could be configured to deliver [deleted] MIRV's. By the late 1980's, this number could be increased to [deleted] MIRV's, each with a yield of about [deleted]. Similar fractionation could be accomplished with [deleted] to the SS-19.

Examples of the capabilities of the fractionated payloads for the [deleted] are shown here. For this example, a technically feasible RV was selected weighing [deleted] to replace the current SS-18 and SS-19 RV's. The yield was assessed to increase from the current [deleted] by 1990, allowing for a [deleted].

As you can see, these configurations would provide the Soviets with acceptably high kill probabilities and damage expectancies against both U.S. Minuteman missile silos and MPS shelters.

U.S. MISSILE PROGRAM IN 1990'S

Senator Laxalt. On that point, before you get away from it, because we run into this all the time, we are constructing a missile system that may be [deleted].

The answer is what, to add shelters, where we are looking in the 1990's.

General Burke. I will be talking to that, sir.

Senator Laxalt. You will be talking to that. All right.

Senator Miller. The intelligence community has projected the size of the potential Soviet ICBM force in 1985 and 1990 for three possible scenarios. All assume that the Soviets are [deleted]. SALT means that the Soviets are conforming to the terms of the SALT II agreement, while no-SALT means that the SALT II treaty terms are not being observed. SALT/no-SALT means that SALT II has been observed until 1985, at which time all treaty limitations end. [Deleted] the number of boosters [deleted] the number of deliverable warheads [deleted]. The [deleted] in deliverable warheads is due to [deleted].

SOVIET ABILITY TO PRODUCE AND DEPLOY MISSILES

Next, let's examine the Soviet ability to [deleted]. We have investigated possible Soviet resource limitations that might preclude either producing or supporting such a weapon inventory. As far as silo and booster deployment are concerned, [deleted]. As you can see from this deployment chart, during the late 1960's the Soviets demonstrated the ability to produce and deploy missiles and silos at the rate of over [deleted] per year [chart deleted]. This rate would allow for the deployment of additional [deleted] launchers over the next decade.

In the late 1970's the Soviets were replacing SS-11's and SS-9 missiles with SS-17, SS-18, and SS-19 missiles at the rate of [deleted] per year. More recently, the Soviets have been replacing reentry vehicles at the rate of [deleted] per year.

Another factor to consider is the availability of [deleted]. The [deleted] in question include [deleted]. Currently the Soviets are [deleted] which indicates that the Soviets [deleted].

[Deleted.]

The requirements for [deleted] cannot be met, [deleted] by [deleted]. But the mid-1980's, Soviet [deleted] will be capable of [deleted] annually. [Deleted.] Therefore, some production will be required to maintain [deleted]. Current intelligence indicates, however, that the Soviets can probably support about [deleted] requiring [deleted]. Now, this is, of course, across all forces, [deleted]. We believe that their——

Senator LAXALT. How many do they have presently using that?

Mr. MILLER. We believe that their [deleted] however, many of these [deleted]. Now, we can't say specifically [deleted] because that is a place where [deleted].

Based on all of the available evidence, we cannot identify any Soviet resource limitations which would prevent them from deploying the number of launchers, missiles, and deliverable warheads that have been projected.

PROPOSED MX-MPS DEPLOYMENT

The proposed MX-MPS deployment will reach full operational capability during the 1990's. The intelligence community at this time is [deleted] of the 1990's ICBM force. We do, however, believe that the Soviets will continue an aggressive development program. We envision ICBM systems that will [deleted]. A system of this type could attain a CEP on the order of about [deleted] meters. It would, however, probably result in [deleted].

Propulsion and structural technology improvements will probably result in [deleted] which could, in turn, lead to [deleted] if required, by the deployment of a U.S. ABM system. We would also expect to see a continuation of the development of [deleted] ICBM's and SLBM's as a survivability hedge against improved U.S. missile accuracy which might place Soviet silo-based ICBM's in jeopardy.

SOVIET MISSILE CAPABILITY BY 1990'S

In summary, we believe that the Soviet Union could develop as many as [deleted] online MIRVed ICBM warheads by 1990. There do not appear to be any resource restraints to limit their development. Not all of these warheads, however, will be available for targeting against MX-MPS deployment. There are still remaining U.S. hard targets such as Minuteman silos, as well as hardened command and control facilities both in Europe and the United States which will require these weapons. This will tend to reduce the availability of hard target capable weapons somewhat.

As alluded to earlier, an area which needs additional study is that of [deleted] faced by the Soviets [deleted].

In conclusion, our assessment is that the major Soviet threat to the proposed MX-MPS deployment will come from the ICBM force of the 1990's. While the cruise missile and SLBM threats are expected to increase significantly over the time period, the limited number of deliverable hard target capable weapons deployed and the major problems of on-target timing tend to discount these threats.

Soviet improvements in ICBM accuracy and warhead yield-to-weight ratios [deleted] of their ICBM force. [Deleted.]

Are there any questions?

Yes, sir.

SOVIET COMPLIANCE WITH SALT II

Senator **Mattingly**. You made a comment about SALT and no-SALT.

Mr. **Miller**. Yes, sir.

Senator **Mattingly**. In 1985, I assume you are talking about supposedly when the SALT II treaty would expire.

Is there compliance now with the SALT II by the Russians as far as in numbers?

Mr. **Miller**. Yes, sir. As a matter of fact, the Soviets announced very recently the intention to dismantle an additional *Yankee* submarine to take the place of the *Typhoon* which is about to go on sea trials. So number-wise they are conforming.

Senator **Schmitt**. But it is appropriate to remember, though, that neither the Backfire nor the 308 heavy boosters are part of that.

Senator **Mattingly**. That was my next point.

Senator **Garn**. Or the fact that at this point they could not have reached those limits in any event. So the fact is that while they are complying, they couldn't have built that many by now.

ACCURACY OF INTELLIGENCE COMMUNITY INFORMATION

Senator **Rudman**. In your presentation, Mr. Miller, you spoke of your earlier estimates in various areas, in mid-1977, and that the Soviets have, in a variety of their technologies, moved the dates up from what the Intelligence Community had originally assessed.

My question is simply this. What would your appraisal be in terms of a fair statement on how accurate our Intelligence Community has been in terms of assessing both the timing and the quality of Soviet abilities in the ICBM area?

Mr. **Miller**. As far as numbers are concerned, our projections have been within [deleted] percent on deployed silos. We have gotten the numbers of SS–17's as opposed to number of SS–19's [deleted] because what they did was [deleted] to build SS–17's and SS–19's. But in the long run it really did not make that much difference as far as total numbers are concerned.

As far as accuracies are concerned, in the early 1970's or late 1960's, we were projecting that the Soviets by the mid-1980's would have about a [deleted] CEP capability. That was a little bit better than they did achieve or will achieve by the [deleted]. In other words, our [deleted]. I think it is [deleted] or something like that.

I will grant you we were, in the early 1970's a [deleted] because we were saying mid-1980's for the [deleted] meter CEP for their force, so we have [deleted]. [Deleted] we have projected where they were going, and we were within a few years of when they would get there.

Senator **Rudman**. Well, my second question is this, then. In the analytical model that you obviously worked with, you must have an analytical model that you plug everything into when you finally come up with your number, you present a number to us here today. That number must in some way come within some range of probabilities that you have.

Mr. **Miller**. Oh, yes, sir. The numbers that I presented you today on accuracy are 90-percent confidence level. That is, the 90-percent number, our best estimate.

REENTRY VEHICLES

Senator **Rudman**. How about in terms of your numbers of reentry vehicles?

Mr. **Miller**. The numbers of reentry vehicles for current systems are [deleted]. For the projected systems, the ones that I gave you were [deleted]. We are not projecting that they will—we say that they have the capability of taking the SS–18, for example, to [deleted] RV's. What we did there was establish a requirement for a kill potential of [deleted] and then take the throw-weight potential and see how many RV's that we can get out of that. And that is where those numbers came from.

POSSIBILITY OF SOVIET RV BUILDUP BY 1980'S

Senator **Rudman**. Well, would it be a fair or unfair statement to say that in light of American intelligence estimates in other areas which have been grossly inaccurate as far as the Soviets—maybe not this area, but other areas—that it is more than possible that based on feasibility studies that you have done that they could have many more vehicles by the mid to late 1980's than you currently assess?

Would that be a shocking development?

Mr. **Miller**. In other words, could they increase the [deleted] RV's on line?

Senator **Rudman**. That's right.

Mr. **Miller**. Not very much because of the [deleted] those limitations.

The [deleted] while it is not an upper worst estimate type of thing, it is getting very close. Unfortunately, our [deleted]. In other words, that is a place where we have got [deleted] as far as telling you [deleted].

I do not think that we could talk [deleted] RV's on line by 1990; no, sir.

Senator **Laxalt**. But you think there is a reasonable probability of [deleted] by 1990.

Mr. **Miller**. Oh, yes, sir.

Senator **Schmitt**. Plus the increased accuracy.

Mr. **Miller**. Yes, sir.

Senator **Laxalt**. What do they presently have?

Mr. **Miller**. They will have by the end of [deleted].

Senator **Laxalt**. So they will more than [deleted].

Mr. **Miller**. Yes, sir.

Senator **Schmitt**. Well, excuse me. If the chairman will yield, that is a [deleted]. What is that in terms of effectiveness?

Mr. MILLER. Oh, it increases the effectiveness as well because the accuracy is improving to [deleted] meters, and now you are talking [deleted] DE against upgraded Minuteman.

Senator SCHMITT. So that [deleted] by 1990 would do the same——

Mr. MILLER. Would do the same job as [deleted] would do today.

Senator GARN. Getting back to the surprise of 1977 and 1978, do you have any assessment of how our sales of high technology such as the [deleted] aided the Soviets in jumping that accuracy figure by a period of 4 to 5 years?

Mr. MILLER. There have been considerable Soviet activities to obtain such things as [deleted] these types of things.

Senator GARN. Well, we sold them the [deleted].

Mr. MILLER. Yes, sir, we sold them those machines, but that was done after the time that the [deleted] started into development. We feel that gave them some support. [Deleted.]

Senator GARN. But after the development they needed physically the [deleted].

Mr. MILLER. And they needed the [deleted] they didn't have previously. This aided that considerably.

Senator LAXALT. You mentioned that there are [deleted].

ECONOMIC CONSTRAINTS FOR 1980'S AND 1990'S DEVELOPMENT

You have not pumped into this equation at all what economic constraints there may be for this kind of development in the 1980's and 1990's.

Mr. MILLER. No, sir, I have not.

Senator LAXALT. Is there any reason for that? Do you think they are just going to do what is required?

Mr. MILLER. That's right. We have had several—there are several Soviet conversations that have been held just recently. The indications are to the effect that the Soviets feel that defense is the No. 1 requirement and they will do anything necessary to be sure that the balance of power doesn't change.

Senator LAXALT. So even if there was a worldwide economic collapse affecting the Soviet materially, that wouldn't affect this situation so far as you people see it?

Mr. MILLER. I wouldn't go so far as to say that, no, sir. I would say under the normal economic, you know, future that we see, we see no economic constraints.

Senator HUDDLESTON. They don't have to compete with food stamps.

General BURKE. But they are estimated to be putting 13 percent of their GNP in the military right now. There has got to be some upper limit on that. They can't go to 100 percent.

Senator LAXALT. Can I turn the problem around just a little?

AMERICAN THREAT TO SOVIET LAND-BASED SYSTEM

What is the American threat to the Soviet land-based system?

Mr. MILLER. You will have to ask the Air Force.

General BURKE. I have some charts that go to that, and I also have a chart on what this costs them and what it costs us.

Senator **Garn**. What about your assessment of the survivability of the air-breathing and sea-based ICBM force? You haven't really discussed that, and that is important in considering land based.

Mr. **Miller**. No, sir, I did not get into that. My tasking was to look at the threat against MPS, and so consequently I did not get into that.

As far as the Soviet capabilities against the U.S. SLBM force, their [deleted] does not appear to be adequate to sufficiently [deleted]. There are certain areas where they can do the [deleted] so to speak.

However, it does not appear to be adequate at this time to prevent the [deleted].

As far as [deleted] are concerned, that is an entirely different situation. The Soviets have an [deleted] which is growing daily. It appears—and these again are preliminary because we are [deleted] that is another whole briefing, but it does appear that they are building a [deleted].

Senator **Garn**. What about a quick assessment of their [deleted].

Mr. **Miller**. They have two of their ICBMs, which are cold launched and [deleted]. We have [deleted] that the Soviets have [deleted] to fourth generation systems, either SS-17's or SS-19's. [Deleted.]

MPS SYSTEM

Senator **Garn**. Just a few more questions on MPS.

First of all, if we get into this scenario you have described, can we keep up with them in a shelter-versus-warhead race?

Mr. **Miller**. You are going to have to ask General Burke that question.

Senator **Garn**. I know what General Burke is going to say. I have talked to General Burke for a long time. I wonder what DIA——

Mr. **Miller**. We see no problem in the [deleted] by the mid-1990's, and that could possibly be extended somewhat if they really see all the need for it.

You cannot completely turn the entire Soviet ICBM force over to an attack against MPS, however, because to get the [deleted] don't forget, you have to do away with your single RV systems, your SS-11's and your——

Senator **Garn**. Well, you have 4,600 shelters initially, so it sounds to me like 4,600 shelters are [deleted].

Senator **Laxalt**. Well, with the accuracy capability you are talking about maybe [deleted] there.

General **Burke**. The MX-MPS system is really insensitive to accuracy.

Senator **Laxalt**. Insensitive to accuracy?

General **Burke**. Yes, sir. You are talking about the increased capabilities, we are talking about against silos. In planning MPS we assumed that if the Russians sighted on those shelters, they would destroy them. It just relies on arithmetic, putting a relatively small number of missiles on a large number of shelters.

Senator **Garn**. Well, that is what I just said, but if they have [deleted] RV's and you have 4,600 shelters, then [deleted].

General **Burke**. Numbers will get you, accuracy won't.

Senator **Garn**. I agree. *We are not disagreeing. That's my point,* [deleted].

Senator **Laxalt**. Well, what we are talking about is an open-ended arms race here aren't we, essentially, with these numbers you are giving us?

Mr. **Miller**. Yes, sir. I am saying that the Soviets have that potential to go to that number. We see no limitations.

UNDERESTIMATION OF SOVIET THREAT

Senator **Garn**. Well, let me make a point. In the 7 years that I have been here, despite what some of the critics of our assessments have said, the generals and everybody are yelling the Russians are coming, the Russians are coming, and there have been underestimates every single time. We have underestimated the Soviet threat.

Now, isn't that a fact? We have been surprised over and over again, just like we were with this 4- to 5-year increase.

Mr. **Miller**. Yes, sir.

Senator **Garn**. So if we can make any assumption at all, we can make the assumption that they are probably wrong again on both sides because it has never been any other way.

Mr. **Miller**. [Deleted.]

Senator **Garn**. The number of silos but not RV's.

Mr. **Miller**. That's right.

Senator **Garn**. And silos don't kill anybody.

Mr. **Miller**. That is right.

TARGETING PROBLEMS

Senator **Garn**. Let me ask one more question along this line. Don't we face a more serious targeting problem? Your own charts showed a tremendous dispersal of Soviet hard targets throughout the entire Soviet Union.

Don't we have a much more difficult targeting problem than they do with our Minuteman force and the projected MX?

Mr. **Miller**. No, sir, that is no real problem. As a matter of fact, in some respects it is advantageous because you now spread out your targeting——

Senator **Garn**. Well, from fratricide.

Mr. **Miller**. [Deleted.]

Senator **Garn**. Well, that is true if we are smart enough to go ABM, which we weren't smart enough when we signed that treaty.

SOVIET ABM PROJECTION

Senator **Laxalt**. Speaking of ABM, where is the Soviet going in their ABM projection?

Mr. **Miller**. They are at the present time, they have [deleted] they are in the process of [deleted]—I'm sorry, let me start over again.

[Deleted.]

Senator **Laxalt**. Is it fair to say that they are moving aggressively forward in terms of [deleted]?

Mr. Miller. Yes, sir. They have not started a major [deleted]. However, they have——

Senator Laxalt. They are precluded from doing so under the treaty, aren't they?

Mr. Miller. [Deleted.]

ABM PROTECTION OF ICBM

Senator Laxalt. Well, as Senator Garn indicated, looking at these numbers here, it appears that they clearly are going to have the capability of [deleted] it just seems from the standpoint of this Senator. How in the devil can we possibly protect our land-based ICBM without ABM unless [deleted]. I mean, really, how are we going to do it?

Mr. Miller. I can't answer that question.

Senator Laxalt. I don't see for the life of us how we can begin to protect the system without ABM?

Mr. Miller. I could only give you a personal opinion on that because I am on the intelligence side.

Senator Laxalt. I understand.

Senator Schmitt. Could somebody just provide for the record here now how many RV's our total force, projected force, Minuteman plus MX will have by 1990 to compare with the [deleted].

General Burke. I will show that in a chart.

Senator Schmitt. What is it, 3,500?

General Burke. No, it is on the order of 4,500.

Senator Schmitt. 4,500?

General Burke. Again, it depends on—there are several alternative threats and there are all kinds of responses to that.

Senator Schmitt. Let me ask also, is there any possibility that we could be surprised by a cruise missile or a bomber attack against the MX or any other system?

Mr. Miller. [deleted.]

We also have some indications of either a [deleted] under way in the Soviet Union, or both, which could also be cruise missile associated.

I believe with our current PAVE PAWS system and that type of defense, why, we should be able to prevent any surprise attack against that weapon [deleted].

CRUISE MISSILE AS FIRST STRIKE WEAPON

Senator Schmitt. We certainly don't have a comprehensive cruise missile detection system around the United States, do we?

Mr. Miller. No, sir, not at this point, not that I am aware of, again.

Senator Schmitt. So doesn't that make the cruise missile a potential first strike weapon so long as you don't have adequate air defense?

Mr. Miller. The problem you have got with the cruise missile is if you get the indication that it is coming, you have given yourself several hours of warning.

Senator Schmitt. But I am saying do we have the capability to provide ourselves with that kind of warning?

Mr. MILLER. I cannot answer that question because I am not an expert.

Senator SCHMITT. Well, you know what the Soviets are doing. When do you think they would have a hard target anti-ICBM cruise missile system?

Mr. MILLER. By the [deleted].

Senator SCHMITT. Why do you look to see them [deleted] in this area?

Mr. MILLER. They have had [deleted] for some reason or other. They have not gone this route. They are just now going this route.

Senator LAXALT. I hate to put an end to this, but we are running out of time, Jim. We appreciate very much your help.

I notice that several of the Senators were taking notes, and I know we have been approaching the brink of very classified material here, and I suppose they should be held by clearance for your, certainly, or destroyed, certainly not taken from the room.

Is that true?

Mr. MILLER. Yes, sir.

Senator LAXALT. Thank you very much.

DEPARTMENT OF THE AIR FORCE

STATEMENT OF LT. GEN. KELLY H. BURKE, DEPUTY CHIEF OF STAFF, RESEARCH, DEVELOPMENT, AND ACQUISITION, DEPARTMENT OF THE AIR FORCE

ACCOMPANIED BY:

- BRIG. GEN. JAMES P. McCARTHY, SPECIAL ASSISTANT FOR MX, DEPUTY CHIEF OF STAFF, RESEARCH, DEVELOPMENT, AND ACQUISITION
- BRIG. GEN. CLIFTON D. WRIGHT, DEPUTY DIRECTOR OF ENGINEERING AND SERVICES, DEPUTY CHIEF OF STAFF, LOGISTICS AND ENGINEERING
- LT. COL. LOUIS T. MONTULLI, ADVANCED ICBM SYSTEM STAFF SCIENTIST, SPECIAL ASSISTANT FOR MX, DEPUTY CHIEF OF STAFF, RESEARCH, DEVELOPMENT, AND ACQUISITION
- MAJ. VICTOR D. BRAS, ADVANCED ICBM SYSTEM STAFF OFFICER, SPECIAL ASSISTANT FOR MX, DEPUTY CHIEF OF STAFF, RESEARCH, DEVELOPMENT, AND ACQUISITION
- MAJ. DONALD J. GRAYBILL, DIRECTORATE OF ENGINEERING AND SERVICES, DEPUTY CHIEF OF STAFF, LOGISTICS AND ENGINEERING
- MAJ. JEFFEREY H. MARKEY, DIRECTORATE OF ENGINEERING AND SERVICES, DEPUTY CHIEF OF STAFF, LOGISTICS AND ENGINEERING

DESIGN AND MODIFICATION OF MX-MPS SYSTEM

Senator LAXALT. We will now go to the Air Force. General, you may begin.

General BURKE. Thank you, Mr. Chairman.

I would like to build on the preceding briefing talking about how the MX-MPS system is designed in its concept now and how it might be modified to react and respond to the various alternative threats that Mr. Miller has just spoken of.

Senator Garn is certainly correct when he points out his concern over land-based ICBM is not new. People have worried about it for a long, long time. The question has always been at what point would they be vulnerable.

Indeed, Curt LeMay, with more foresight than most of us, had objected to putting them in the silos to begin with because he said it was inevitable at the time that they would be put at risk there.

But concern with that grew pretty steadily during the 1970's as we saw more and more evidence that the Soviets had made a policy decision that we as a nation had rejected, and that was that they were deliberately going to make large investments and build a very large force of highly accurate ballistic missiles which would put at risk and threaten our silos. We could have done that earlier, and we debated it, and we decided that was destabilizing and chose not to go down that path for whatever reasons or whatever thought processes. They thought it was a good thing and they pursued it.

EXCHANGE RATIO IN MISSILE USE

We never imagined that we could build a basing mode for the MX ICBM that would make them absolutely impervious to attack. There is almost no such thing as a weapon that can't be attacked by one means or another. But again, from the beginning we were looking for a system that would provide us with what in the jargon is called a favorable exchange ratio. Any military planner contemplating an attack has to calculate what he is going to gain against what it is going to cost him, and if he is going to spend a lot more of his force than he could expect to destroy, he should then prefer his beginning position to his end position, and he ought to be dissuaded from launching that attack, with one exception, and that is if he has such an overwhelming force that he can, even with the unfavorable exchange ratio, do you in; then that doesn't count. That is really the way Grant won the Civil War, accepting a two-to-one unfavorable exchange ratio.

So it is important to have that exchange ratio in your favor, but it is not sufficient. You also have to look at the total balance.

SATISFACTORY ALLIANCE OF ABM WITH MPS

The MPS system, as it was originally laid out on what was called the baseline was designed to cope with the best guess as to what the Soviets were going to deploy in terms of ICBM's, around [deleted] accurate ballistic missile warheads, and indeed it does extract a very favorable exchange ratio, and I showed you that in a short form a little earlier.

From the beginnning we pointed out that that 4,600 shelter, 200 missile force was national, and that it could be made larger, it could be made smaller depending on what force actually we were confronted with. We can make it larger by increasing the number of shelters. We can make it larger by increasing the number of missiles in the shelters, or some combination thereof.

But the real ace in the hole you have already alluded to, Senator Laxalt, and that is the ABM makes a very happy marriage with an MPS system, and I think the country ought to make, if we do embark on this course, we ought to make it clear at the outset that we don't have any intention of digging up half of the United States to build shelters. At some point, and we will let them know when they get to that point, the ABM treaty doesn't count.

After all, the purpose of the ABM treaty was to limit RV's. If they are at the point of [deleted] the ABM treaty failed, and we might as well scrap it.

Fortunately, it looks like we can expand the capability of this system at slightly less cost than they would incur in posing the additional threat, and that is, I think, not unimportant. But it seems to me the most important thing is that if we do elect MPS as the proper survivable basing mode for our land-based ICBM, we need to make it crystal clear as we embark on this program that we have not only the capability but the will, and indeed, the determination to match any increased Soviet threat, that we will provide what inducements we can to reduce that threat—and I think we have several tools that we can do that with—but that if they wish to expand their threat, we are going to keep pace, regardless. And we can and we will.

With that background, I would like to go through some charts I think will illustrate the points that are important here.

[CLERK'S NOTE.—Due to the sensitive nature of their content, all charts and illustrations referred to in the testimony have been withheld from publication.]

THREE CASES ON MISSILE DEPLOYMENT

First, just to relate what I am going to say to what Mr. Miller has already said, we are going to be looking at generally three cases. The bottom line is what is called the SALT constrained, and again it is not SALT treaty constrained, but it is sticking with the numbers approximately as they now exist in the defunct SALT II treaty. That is the best guess as to what they would do if they adhere to those numbers, although theoretically by increased fractionation they can go from the [deleted] or so to about [deleted] and finally, the no-SALT or no further pursuit of arms control positions, they are up to about [deleted]. I will talk as to some ways we might respond to each of those three.

As I mentioned, we can respond by increasing shelters, increasing missiles, some mixture thereof, or by ABM, and these are just notional alternatives of ways that we could go to show what we would require and what we would spend.

If they do what we expect and deploy a few more than [deleted] warheads, then this 200 missile, 4,600 shelter no-ABM concept suffices, and that costs us about $34 billion in 1980 dollars.

If they stay with the overall SALT numbers but they increase the fractionation and get up to [deleted] warheads and spend a lot of money on improved accuracy, one response that maintains a comfortable position now I will illustrate in a minute, is to add missiles up to the level of 350, to add shelters to 6,900, and an important point to that number, Mr. Chairman, is the baseline system of 4,600, as it is designed now, is only two-thirds filled. There are vacant spaces within that grid. Every third one is vacant. So without adding additional land or spreading out further, you can increase that from 4,600 to 6,900, retaining the same 1-mile spacing. So that would not be an uncomfortable thing to do.

Again, we have not yet added the ABM, and the additional cost there takes it up to $45 billion, and I will relate that to Soviet costs on a later chart.

And the final case, as we have already discussed, really, is if they go to this [deleted] RV case, the ABM treaty doesn't count for much. We go ahead and deploy that along with the 6,900 shelters, a somewhat smaller number of missiles. We do all of that for $50 billion.

EXCHANGE RATIOS OF THREE CASES

Now I will show you with some other charts what the consequences of those three cases are in terms of exchange ratios, and this is sort of a standard drawdown chart that military operation analysts work with all over the world. We work with them, and the Russians use the same chart.

It shows after either a U.S. first strike or Soviet first strike, either the residual U.S. ICBM weapons or the remaining Soviet ICBM weapons. The dotted line is a line of parity which we would have equal number, we have got 4,000, they have got 4,000. It shows right off that they start with about twice as many RV's as we have, but that is not particularly disturbing because we have a better balanced Triad. So we wouldn't make too much of that.

And it shows that if the Soviets initiated a first strike attack, the most attractive targets they have are the Minuteman III's, because there they have the potential of destroying three warheads with one. So they are having a very successful drawdown of our force there.

The next set of targets then would be the Minuteman II's and the Titan's, the single warhead missiles, and that takes them to this point. They are still doing very well.

Then when they add in the attack on the MX and the MPS, they don't do well at all because of the arithmetic. Whatever silo they shoot at they hit, but they are using, for every 25 warheads they send, they are destroying 10 MX warheads. So they have an adverse exchange ratio of 2.5 to 1.

Now, interestingly, and of great significance, is that just the reverse is true for the United States because the MX is itself a very efficient silo killer. The Soviets, with a much larger amount of their force in the silo, and larger number of RV's in individual silos, now become quite vulnerable to threatened attack from our MX system, and what this shows is the numbers just about reverse. For each ten warheads we shoot at the Soviet Union, we could destroy about 25 of their warheads. So we have a favorable exchange ratio of 2.5 to 1, and theirs is just the opposite, unfavorable.

VULNERABILITY OF SOVIET WARHEADS IN FIXED SILOS

Senator **Rudman**. Does that have something to do with the way they are deployed?

General **Burke**. It has something to do with the fact that they have up to 10 warheads in a single silo, all vulnerable to 1 warhead.

Senator **Rudman**. That is their average right now?

General **Burke**. That is not the average. On average they have a lot more warheads per shelter than we do.

If they go to the second case that was discussed, remaining in the SALT II overall numbers, but as much fractionation and increased accuracy as they can, they wind up with substantially more warheads than we would have, and this is the beginning point. Once again, if they make the attack, they are doing very well against the Minuteman, pretty well against the Minuteman II and Titans, but it falls off very quickly as they go after those MPS again because of the arithmetic, and their exchange ratio remains adverse from their perspective in that they are using more than two of their warheads for each one of ours that they might hope to destroy.

Interestingly, in doing this, they have packed their silos with warheads. That is how they got these big numbers. And they are all the more vulnerable to a first strike attack on our part, and our exchange ratio here is on the order of five to one that we are destroying of theirs.

I want to get back to that point, but that has got to worry the Russians, and they are going to have to account for it in their planning.

This is the third case, the extreme case. They have deployed the 14,000 warheads. They now outnumber us by something on the order of 3 to 1. We have responded by some increase in shelters and missiles, but added the ballistic missile defense. And the same pattern, initially doing well against the silos, but notice how flat this curve now goes, and that just illustrates the natural harmony of an ABM system with a multiple protected shelter, and the reason you get that is that you are selectively defending the loaded shelters and ignoring the attack on the unloaded shelters.

EXCHANGE RATIO OF MISSILE DESTRUCTION

And that brings the exchange ratio down to an adverse average of taking eight of their warheads to destroy each MX warhead. And conversely, again, as they have continued to pack the silos, we now have a favorable exchange ratio of about 8 to 1 against them.

Just to show that same data in tabular form, it is from my point of view highly undesirable and destabilizing to have a force that can be attacked wherein the Soviets would enjoy a favorable exchange ratio, and they certainly can hurt our silos. They can kill warheads in silos, getting one of ours for about half of theirs. That is the undesirable part. But as that moves into the three cases we illustrated there, that changes very quickly for the MX case to unfavorable exchange ratios, 2.6 to 1 in the first case, 2.1 to 1 in the second, and better than 8 to 1 in the case where we have added the ABM.

U.S./SOVIET COMPARATIVE MISSILE COSTS

Economics are important. If we really don't believe the all-out exchange is likely to take place, but really do believe we are going to be engaged in a strategic competition with the Soviets for decades until the end of the century, we want to look very carefully at what we are spending relative to what they are spending, and what the interaction is.

This chart first shows that the Soviets have made very substantial investments up to this point. They have spent about $80 billion in the past 10 years to field this threat that now puts our missile fields at risk, and I have never heard any argument as to why they would have spent that great sum of money other than to put at risk our silo-based ICBM's. They didn't need that accuracy to get cities or our bomber bases or army camps or anything else. They do need it for silos. So we are trying to cope with a threat that represents very substantial Soviet investment already made.

Our expenditure line has been relatively low. They haven't really been doing much in their missile field, adding more 12A's is the more expensive thing we have done. It will, of course, start to move up rather sharply with the MX, and if the Soviets field the first threat we talked about, the [deleted] warhead threat, then we would be in the solid line here, and the Soviets continuing to field that threat would be on that solid line there, and it is better than a two to one disparity in their spending over ours.

And if they go to the higher, no-SALT threats, they spend what is shown on the dashed line and we spend what is shown on the dashed line, and that is a little bit more for them than it is for us, but not that much.

SOVIET OUTLAYS FOR STRATEGIC FORCES

Another way to look at it and have some perspective is to see what the Soviets are going to spend on strategic forces relative to what we have and plan to spend on it, and I think this is a rather dramatic chart in that it shows that the best estimate, national inteligence estimate, is that for the past 10 years the Soviets have been outspending us for strategic forces by something approaching three to one, and that is what has taken us from a position of clear leadership to a position where we are no better than equal and in many things we are falling behind.

From 1980 on we just showed that at a 3-percent growth, and we don't know. That is about what they have been spending in the past, and if they do at 3 percent, it would go up at about that line. That is just a guess.

If we don't build the MX, we build everything else planned, the Trident, the cruise missiles, build a new bomber, our expenditure line would look like this. If we add the MX baseline system, it looks like the solid line. If we go to that threat after we add the ABM, then that looks like this dashed line. So that is about the highest we might imagine.

Two points to be made: one, it is first well less than the Soviets are spending on strategic forces, or perhaps have, and just by comparison, it is substantially less than the United States was spending in constant dollars back in the 1950's and 1960's when we were dealing with a threat that was minute compared to what we are dealing with now.

SUCCESS OF SOVIET MISSILES BARRING THREAT OF U.S. MPS SYSTEM

We also need to think a little bit and worry a little bit about what the Soviets can do with their weapons if we don't have an MPS system, and I would like to just illustrate that problem.

Absent an MX-MPS or something comparable to the MX-MPS, and assuming that the Soviets attack our silos 2 for 1, that uses up 2,106 missiles in the three cases we have been talking about. That leaves them, in the first case, with 3,800 weapons looking for targets, if you will. In the second case, the upper SALT bound, leaves them 6,500 weapons, and in the [deleted] case they have got almost 12,000 weapons and targeteers looking busily for something to do with them.

What can you do with them? One thing you can do is if you have that number you can seriously contemplate bombarding the bomber fly-out corridors, a very profligate and expensive way to attack, but if you have got the weapons, you can do it. Those are the three cases, A, B, and C. C is the [deleted] case; B is the [deleted].

And this line reflects the B-52 force on its 12 home bases. This line reflects that we have dispersed and we are now on 26 bases, and you can pick whichever one of these you want, but at the very best case, where they have [deleted] warheads and we dispersed, they could bombard the corridors and destroy about 40 percent of the B-52's on flyout. And if you go to these more extreme cases, you can imagine, at least, that they could get virtually all of them.

CAPABILITY OF SOVIET MISSILES TO SEEK AND DESTROY U.S. SUBMARINES

You would have to worry a little bit about submarines, too. If they have that great inventory of weapons—and I have no qualifications to make any predictions or observations about ASW or when or if anybody is ever going to solve that problem—this is just, this is arithmetic, and what it says is this. It shows radius of location uncertainty here, and the number of extra warheads that are available to the Soviet Union, and what the question is is how precisely do they have to locate a submarine before they can successfully attack it with their inventory of weapons. That is the question.

And what that shows is if they don't have a small number of weapons to put to that test, they essentially have to pinpoint that submarine. They have got to know right where it is so they can go right after it.

As they have large inventories of surplus weapons available, in the best case, the [deleted] warhead case, they have enough warheads left over to successfully destroy 90 percent of the submarine fleet which is shown at 30, which is probably high. Ninety percent of those, if—and this is a very big if—if they could localize that in a circle with a radius of 75 miles, a circle 150 miles across, they would have enough weapons to bombard that and destroy any submarine that was in that area.

As you go to the higher numbers, the C case, the [deleted] that gets up to 125 mile radius, if they can identify a submarine as being in a circle 250 miles across, they could destroy to a 90-percent probability all of those submarines.

DNA STUDY OF U.S. FATALITIES FROM SOVIET MISSILE ATTACK

Another way to look at this is what they might do with those additional weapons against the homeland of the United States, and this is a calculation we asked the Defense Nuclear Agency to do for us, and we are going to talk about fatalities, and it is an unpleasant, even a gruesome subject, but I think it is very relevant to your deliberations.

DNA calculated that if the Soviets mounted a counterforce attack against the United States, absent MX, went after the silos, the bomber bases, the sub bases, the nuclear storage sites, they would use about 3,000 weapons to do that job and would kill about 25 to 45 million Americans. And you have to allow wide latitude in the assumptions because it depends on the winds, how they are blowing and what time of year it is. If in addition to that counterforce attack they set a goal of destroying 70 percent of the American industry, they would attack with about another 1,000 weapons, and the casualties would rise sharply because they are now getting into cities, and on the order of 70 to 90 million Americans.

If we were to add MX to the equation and the Soviets were now to make this counterforce only attack, but now against the MX, and add 3,000 weapons attacking the system, the casualties would go up a relatively small number, and the reason for that is the fallout patterns would be essentially the same as they were there, and you can't kill people but once.

On the other hand, if those 3,000 extra weapons were available and they decided instead of 70 percent of the industry they wanted 90 percent of it, they could apply that to the cities as well, and there you get very marked increased and fatality predictions.

IMBALANCE OF SOVIET TRIAD FORCE

And final two charts, and I think the most important I have in the briefing, and I will illustrate why I don't think the Soviets are about to make large increases in the number of their silo-based missile force, and that is the intent of these next two charts, to illustrate the problem from the Soviet perspective, and I have tried to think through this as a Soviet air marshal might as well as we would on our side. I started this chart back in 1978, and I am showing the total available weapons in our inventory and in their inventory, and I have them in three categories. On the bottom are the land-based ICBM's, in the middle are the SLBM's, and on the top are the bomber weapons.

We begin in 1978 and note right off that the United States has a nicely balanced Triad. We are pretty well divided. The Soviets are predominantly an ICBM force, as Mr. Miller pointed out. If the United States had decided in 1978 to make a preemptive first strike against the Soviet Union and they had not launched on warning, the consequences would have been as shown here, which looks somewhat displeasing from a Soviet perspective. But notice that we get all of their bombers and virtually all of their submarines, and that is because they maintain the alert rate. So that they did have an option of spending money to put more of that force on alert, and they could have pushed that up.

On the other hand, there clearly was no mathematical attraction for them to attack us. They were not improving their relative position in any significant way if they made that first attack on us.

From now on—this is 1978. I am now going to move to 1989 for all of the remaining examples. And the first illustration is in 1989 in which we have done everything in our current force planning except we have not built the MX-MPS, the Soviets have built that [deleted] RV force, the preattack position shows us looking there—and I might just digress a minute and say I am showing that the measure here in terms of warheads, which is the way that it looks best from our perspective, but if we show this in megatonnage, it would change and the Russians would look better to begin with. And again, we have no attraction to pre-empting. We are not going to have any particular success against the Soviets.

But notice now they can make a fairly dramatic reversal in these numbers. Again, this would be even more dramatic if we did it in terms of megatonnage, going from a position where the United

States had a lead in the warhead, they now have a very marked lead in warhead. But there is something that is even more worrisome about this chart, and I want to call your attention to the fact that the preponderance of that force is in that middle area, and that is 21 submarines. That is 21 aim points.

SOVIET MISSILE PROGRAM POISED AS THREAT

Now, I think as the earlier conversation went that because the Soviets make that kind of calculation they will walk in and push the button and blow us up and see what we do, but I do think that that circumstance, if we allow it to happen, can be translated into political utility by the Russians. I think it was Senator Schmitt who suggested it will be there as a threat. Even if unstated, we will always know it is going to be there, and I think in doing our business around the world, I think personally, to the extent that the Russians see themselves as ahead in this important area, which they will, they are going to be more adventuresome, more willing to take risks. To the extent we see ourselves behind, we are going to be less willing to interpose ourselves between them and the objectives, and I think if we have any concern about this area at all here, we are going to be in quite difficult circumstances.

Senator **Schmitt**. Would that B section there assume no ABM?

General **Burke**. No ABM. It is everything in the current defense plan minus MX-MPS, but no ABM.

Senator **Schmitt**. Minus MPS, but does it assume MX deployment at all?

General **Burke**. No, no MX, no MPS. It retains the 1,054 silos, but those being Tridents, cruise missiles, new bombers.

Now, the third case is still 1989, and the only change is we have now built an MX-MPS. I would like for you to look at what a dramatic change that has on this correlation of forces, to use the Soviet favorite term. We have about the same lead at the beginning position. Now, if the Soviets go first, they don't change that at all and that is because of the inherent resiliency of the MX-MPS system and the fact that they are having to accept very unfavorable exchange ratio in attacking it. But this is the point that I want you to particularly focus on. That is the way it looks from a Russian planner's point of view. He is extremely vulnerable to the threat for first strike, and the Soviets do worry about United States first strike. They spend good money to guard against it. Their silos are much harder than ours. They have already built and deployed intercontinental ballistic missiles on submarines, obviously for survivability. They are developing and fielding more for that purpose. So they do think about this. They do worry about survivability.

That, I just don't see how a Soviet planner or Soviet leader could find that an acceptable circumstance.

SOVIET ALTERNATIVES TO MX-MPS DEPLOYMENT

And I would now like to look at what alternatives the Russians have to deal with that.

The first is they could build those threats that were held out as feasible earlier. In fact, I will even show one more extreme than this that Mr. Miller talked about. This is what happens if their response to MX–MPS is to go ahead and deploy that [deleted] RV threat, that moderate no-SALT condition. Now they we have more warheads than us, a whole lot more than we do, but again notice that if we preempt, and at this point we have added 6,900 shelters, if they preempt at this point, the balance shifts in our favor, and that is again because they have an unfavorable exchange ratio. They still are highly susceptible to the U.S. preemptive first strike attack. They have not solved that problem in any appreciable way.

NO–SALT HIGH THREAT

The most extreme case—and somebody asked that question earlier—also has been covered in past NIE's, and that is what is called a no-SALT high threat, and this just assumes they throw every ruble they have got at the problem and they quit building other things, and they build just as many and as fast as they can, and it does not come up a whole lot different, as Mr. Miller pointed out. But that takes you to this level. The same circumstances, attacking us, does not profit them. They lose in the relative balance, but they are still very, very vulnerable to an attack by us.

I think that is unacceptable from the Russian point of view. They have—I think it is probably dangerous for us to deploy MX–MPS overnight, if we had that capability, which obviously we don't. So the Soviets have between now and 1989 to come to grips with the problem that MX and survival basing mode poses a very real threat to them.

There are a couple of things they can do, and the last two bar graphs are just notional. I pulled them out of the air.

This one assumes that their response to MX–MPS is to build some sort of an MPS system of their own. Probably it wouldn't mirror image ours. Probably it would be a road mobile system. But all of that costs a whole lot more money than putting them in the silos. So the money is being done for survivability rather than for a threatening force, and the consequence to that comes out just where you want it, with neither side holding up an advantage by going first.

Or alternatively, the imminence of MX I think could well encourage the Soviets to more meaningful arms control negotiations, and in my last example I just hold out a hypothetical case in which we have had some success in arms control and we have reduced all those forces by about 30 percent with the same happy condition now there that neither side gains by going first.

And in a world in which you have two unfriendly superpowers with large nuclear arsenals, the best that could be imagined is the condition that neither side could profit from the first attack.

Senator LAXALT. General, we have a vote on and I am looking at the time.

Would it be inconvenient for you and your crew to return at 2 o'clock?

General BURKE. No, sir. We would be delighted to do that.

I am essentially completed. In fact, that is my last chart.

We will move into General McCarthy's presentation.

First I will entertain questions on the subject.

Senator LAXALT. Why don't we entertain whatever questions we have of the General ahead of the bells.

Mac or Warren?

Senator MATTINGLY. I just have one comment. I think your charts are great, very informative. A Soviet planner looking at us historically would not assume that we are going to have a preemptive strike, though.

General BURKE. You shouldn't underestimate the Soviet concerns about defense. I think the Soviets are very much a product of their history, as are we. For instance, one of the great disparities in our defense philosophies is that the Soviets continue to spend what we would consider just unreasonable sums for air defense, and people say that is just paranoia on their part, and I say if we had a history of 2,000 years of invasion from every direction, we would be a little more serious about air defense and other types.

Senator MATTINGLY. Now, I said the assumption that we would have a first strike though.

General BURKE. I think they would view it as highly unlikely just as I view theirs as highly unlikely, but I think it is inherently unlikely, it is inherently implausible, but I think a fair reading of history will show that wars have started for unlikely and implausible events. The people up at the Hudson Institute like to do what they call war-starting scenarios, and they have done literally thousands of ways you can start wars.

Herman Kahn & Co., one of Herman's observations is that although they have done all of those, they have never been able to write a plausible scenario to start World War I. It is just ridiculous on the face of it, but it happened.

SUBCOMMITTEE RECESS

Senator LAXALT. All right, we will be in recess until 2 o'clock.

[Whereupon, at 11:55 a.m., the subcommittee was recessed to reconvene at 2 p.m. the same day.]

[AFTERNOON SESSION, 2:08 P.M., TUESDAY, JUNE 6, 1981]

CONGRESSIONAL WITNESSES

STATEMENTS OF:

HON. HARRISON SCHMITT, U.S. SENATOR FROM NEW MEXICO
HON. WILLIAM V. ROTH, U.S. SENATOR FROM DELAWARE

INTRODUCTION OF WITNESSES

Senator LAXALT. We will be in order.

I understand that Senator Roth has a time crunch, and that being the case, if the people of the Air Force don't mind, perhaps we can suspend your testimony a bit until Senator Roth can testify.

We welcome you to the hearing, Senator Roth. The subcommittee will be pleased to hear anything you have to offer with respect to this.

Whatever order you would like.

ALTERNATIVES TO MULTIPLE PROTECTIVE SHELTER BASING MODE

Senator SCHMITT. Mr. Chairman, Senator Roth and I, as you are aware from previous discussions with you and Senator Garn and others, have come to the conclusion that the multiple protective shelter basing mode, when balanced against other alternatives available to us, does not make good sense for this country. There are technical alternatives that we feel can be made available in the nearer term to reduce the window of vulnerability and begin to eliminate it once and for all in the future, and to do so at dollar costs that are significantly less than MPS combined with other activities that we will require.

And I don't think we can emphasize either one over the other. They are both, I think, very important points.

Senator Roth will deal with the economic questions principally and I will deal with the more technical ones.

I think it might be appropriate, since we have heard so much technical discussion this morning, to maybe try to bring the budget picture into perspective and then I can discuss in more detail our technical proposals.

Senator LAXALT. Very well, Senator Roth.

Senator SCHMITT. I think it is very important to keep in mind the funding wedges that we are going to have out there in the future, and the fact that not only are we going to try to provide an adequate national defense, but we are committed to providing an adequate national economy simultaneously.

Senator Roth.

PREPARED STATEMENT

Senator ROTH. Thank you, Mr. Chairman, Senator Garn. I greatly appreciate the opportunity of appearing here before you.

I will not read the entire statement but would ask that it be included as if read.

Senator LAXALT. Without objection, so ordered.

[The statement follows:]

PREPARED STATEMENT OF HON. WILLIAM V. ROTH, JR.

U.S. SENATOR FROM DELAWARE

Mr. Chairman, I am here with my colleague and friend, Senator Schmitt, to recommend alternatives to deploying MX missiles in multiple protective shelters. Senator Schmitt has addressed the technical aspects of our suggested alternatives, and he is more expert than I in those matters. I want to address the implications of the proposed MPS scheme for our national security and for the U.S. economic recovery program.

I am concerned, as I know the members of this committee are, that we have allowed our national defense to erode over the past decade. I fear that the deterrent value of our strategic and conventional forces may no longer be credible in Soviet eyes, nor in the eyes of our friends and allies around the world. In particular, I want to stress the "window of vulberability" faced by our strategic missile force beginning perhaps as early as 1982.

We have allowed the Soviet Union to achieve not only strategic nuclear parity, but to gain an edge.

Moreover, I am concerned that the solutions to our defense dilemma are not grounded on a strategic concept for a coherent program to regain the initiative from the Soviet Union. Instead, we appear to hearken back to the strategies and weapons of the past two decades when we should be constructing a strategy for tomorrow. We should be building weapons that leapfrog Soviet capabilities and aim at making weapons of mass destruction obsolete.

Many of the programs that have been proposed to rebuild our military capability and to redress the "window of strategic vulnerability are depressing familiar. The weapons are the same ones that have been on various people's "wish list" for years. The prospect of larger defense budgets over the next decade seems to have provided the excuse to trot out all the weapons proposals that we have been hearing about year after year.

I submit this is not the way to properly plan our national defense. No longer does this country have the luxury of spending freely on defense with little consideration for the economic implications. A strong and robust economy, free of the scourge of inflation, is the most fundamental underpinning of a strong national defense. Runaway defense spending is as sure to inspire a backlash in the country and in the Congress as excessive spending on wasteful social programs did. Every dollar we spend on defense must buy the maximum in real military capability, and must be programmed within a coherent strategy to redress our vulnerabilities.

As the two charts show, our alternative offers not only substantial savings but also significant improvement in the dates of operational capability to meet the threat to our strategic forces. Our program saves $2.1 billion in 1984—the target year for a balanced budget; it saves $3.1 billion in 1986, the year that both programs would peak in cost. Moreover, through 1987, our program would save a total of about $15 billion.

The priorities should be clear. We must first address our strategic vulnerability in the 1980s—with programs that impact in the early to mid-1980s, not half a decade later. We must restore the credibility of our deterrent, and we must put the Soviet Union and the world on notice that the U.S. will no longer accept second place.

MX missiles deployed in the MPS shelter scheme will not be available in numbers until the late 1980s, will not be fully deployed until the early 1990s, and will drain the Defense treasury at the expense of other needed programs. We do need the MX missile. But spending $40 to $50 billion dollars or more on its basing is not sound economic policy. In the context of our defense requirements, it is not a sound military policy either.

> *The system will be deployed too late at too great an expense. If the track record for such massive defense programs is any guide, it will be delayed further by technical problems and the costs will increase drastically.
>
> *Public opposition to the basing scheme is bound to result in litigation which will only further delay its deployment.

Moreover, the whole MX/MPS scheme will bind the U.S. for the foreseeable future to continued reliance on the doctrine of mutually-assured destruction—MAD. It means reliance on ever-increasing inventories of weapons of mass destruction. It vastly increases the territory and population of the United States that is held hostage to nuclear attack. And it puts too many of our strategic "eggs" in one basket.

In fact, by improving our command and control and our early warning and attack assessment capabilities with systems such as SOFAS, the U.S. could develop a realistic launch under attack option. The rationale for deceptive basing of MX would no longer be valid.

Our alternative proposals are based, first and most importantly, on a new strategy. They offer a more economical approach to solving our critical defense problems in the near-term while building toward defenses for the future based on America's greatest strength—our technological superiority.

Succinctly stated, our alternative strategy would commit the U.S. firmly to moving away from reliance on weapons of mass destruction to a reliance on defending our offensive forces and eventually our population and territory. In the near-term, it would diversify the threat we present to the Soviet Union, and thus ensure that a Soviet first-strike could not succeed.

The key elements of our proposal, then are three:

*First, deploy MX missiles in fixed silos.

*Second, defend them with a terminal, low-altitude ballistic missile defense in the short-term and an overlay defense in the future.

*Third, diversify our offensive capanility by deploying large numbers of cruise missiles while proceeding seriously with our efforts to develop the next generation of submarine-launched ballistic missiles—such as Trident II that have a hard-target capability.

Senator Schmitt has already addressed the details of our alternatives, but let me emphasize a few key points.

We believe the program we have outlined addresses a broader range of our defense requirements than would be possible if MX/MPS is funded. The money to continue other recessasy programs simply will not be available if we spend $40-50 billion for MPS.

Nor do I believe, that by moving into ballistic missile defense, we will be violating the treaties that now limit such weapons. The ABM treaty permits deployment of an ABM system to defend one missile field or one national command center. Our proposal would conform to this stricture. Furthermore, the Soviets already have an ABM sustem deployed, and Have, since the signing of the treaty in 1972, been conducting vigorous programs to develop ABM capabilities, I for one will not be surprised if the Soviets withdraw from the treaty in the next several years. Can we afford not to have a robust program to meet such a contingency? Especially when our superior technology could give us a real edge in the field?

Finally, I believe I share with other members of Congress, and with the American people, a concern that real arms control arms reduction, if you will—is in the long run our best assurance against a massive nuclear war. Our alternative, by presenting the Soviets with evidence of a U.S. determination to be second-to-none in defense and by presenting them with a diversified threat that truly deters a first-strike, may well cause the leaders of the USSR to sit down and negotiate real and enforceable arms limitations.

In sum, our proposal recommends terminating funding for the MPS basing scheme for MX missiles, and pursuing a mix of strategic programs that put weapons in the field in the near-term to redress our vulnerabilities. It offers a strategy for long-term defense that moves away from reliance on weapons of mass destruction. It offers more real security to our people, not perpetual status as hostages of the MAD doctrine. Our proposal suggests a way of evaluating overall defense programs, not a service-by-service piecemeal approach.

And, as the figures we have presented indicate, we believe that our proposals are more cost-effective. In the near-term, they do not threaten the goal of a balanced budget, and in the long-term they buy more real calability.

I thank the subcommittee for this opportunity to present my views.

IMPLICATIONS OF MPS SCHEME

Senator **Roth**. As Senator Schmitt has read, he is the technical expert; I am not. But I do want to address the implications of the proposed MPS scheme for our national security, for the U.S. economic recovery program.

Let me start out by saying, Mr. Chairman, that I am concerned, like the members of this subcommittee, that we have allowed our national defense to erode over the past decade. I fear that the deterrent value of our strategic and conventional forces may no longer be credible in Soviet eyes nor in the eyes of our friends and allies around the world. In particular I want to stress the window of vulnerability faced by our strategic missile forces, beginning perhaps as early as 1982.

We have allowed the Soviet Union to achieve not only strategic nuclear parity, but to gain an edge. Moreover, I am concerned that the solutions to our defense dilemma are not grounded on a strategic concept for a coherent program to regain the initiative from the Soviet Union. Instead we appear to hearken back to the strategies and weapons of the past two decades when we should be constructing a strategy for tommorrow.

I believe we should be building weapons that leapfrog Soviet capabilities, and aim at making weapons of mass destruction obsolete. For that reason I am concerned that many of the programs that have been proposed to rebuild our military capability and to redress the window of strategic vulnerability are depressingly familiar. They are the same ones that have been on various people's lists for years. The prospect of larger defense budgets over the next decade seems to have provided a reason to trot out all of these proposals, and I, for one, believe this is not the way to properly plan our national defense.

Mr. Chairman, I think it is important to emphasize that no longer does this country have the luxury of spending freely on defense with little consideration for the economic implications. A strong and robust economy, free of the scourge of inflation, is the most basic underpinning of a strong national defense. Runaway defense spending is as sure to inspire a backlash in the country and in the Congress as excessive spending on wasteful social programs has done. Every dollar we spend on defense must buy the maximum in real military capability, and must be programed with a coherent strategy to redress our vulnerabilities.

ALTERNATIVES TO MPS SCHEME

Mr. Chairman, we have two charts here. Our alternative, which Jack will discuss in some detail, offers not only what appears to be substantial savings, but significant improvement in the dates of operational capability to meet the threat to our strategic forces. It is estimated that our program would save $2.1 billion in 1984, the target year for a balanced budget, a target that I think is of critical importance to our national economy. It would save $3.1 billion in 1986, the year that both programs, our proposed alternative as well as the MX-MPS, would peak in cost. Moreover, it is estimated that through 1987, our program would save a total of about $15 billion.

The priorities should be clear. We must first address our strategic vulnerability in the 1980's with programs that impact in the early to mid-1980's, not a half-decade later. We must restore the credibility of our deterrent, and we must put the Soviet Union and the world on notice that the United States will no longer accept second place.

MX missiles deployed in the MPS shelter scheme will not be available in numbers until the late 1980's, will not be fully deployed until the early 1990's, and will drain the Defense treasury at what, I believe, is at the expense of other needed defense programs. We do need the MX missile. But spending $40 billion to $50 billion or more on its basing does not seem to be sound fiscal policy. In the context of our defense requirements, I don't think it is a sound military policy either. The system will be deployed too late at too great an expense. If the track record for such massive defense programs is any guide, it will be delayed further by technical problems, and the costs will increase drastically. Public opposition to the basing scheme is bound, in my judgment, to result in major litigation which will only further, and I would underscore substantially further, delay its deployment.

Moreover, the whole MX-MPS scheme will bind the United States for the foreseeable future to continued reliance on the doctrine of mutually assured destruction. That means reliance on ever-increasing inventories of weapons of mass destruction. It vastly increases the territory and population of the United States that is held hostage to nuclear attack, and it puts too many of our strategic eggs in one basket.

In fact, by improving our command and control and our early warning and attack assessment capabilities with systems such as SOFAS, the United States could develop a realistic launch under attack option. The rationale for deceptive basing of MX would no longer be valid.

Mr. Chairman, rather than for me to list what we propose as our alternative, in the interest of saving your time, I will defer to my distinguished colleague, Senator Schmitt.

Senator SCHMITT. Mr. Chairman, I thank the Senator from Delaware. It is very worthwhile and stimulating to be working with him on this.

FALLACY OF MAD POLICY

I think it is clear that U.S. foreign and defense policy has been based on the policy of mutually assured destruction, as the Senator said, and based on it far too long. It is a policy which is wrong militarily, it is wrong politically in this day and age, and most importantly, it is now wrong morally in view of the new technologies that are becoming available.

It is also a policy which has never been accepted by our principal adversary, the Soviet Union. We must use our technology to move forward a policy of protection rather than one of destruction. We must move forward so that weapons of mass destruction, as the Senator has said, become obsolete in the face of advanced nonnuclear technology and strategy.

I think it is clear to everyone now that the Soviet Union has continued to build its military forces, especially its strategic forces, beyond any reasonable definition of "self-defense requirements." More important, it is the kind of buildup which the Soviet Union has undertaken which leads me to conclude that we have followed generally the wrong path in countermeasures. The Soviets have concentrated on large land-based ICBM's with a hard-kill counterforce capability. This capability would not be needed if the Soviets accepted the policy of mutually assured destruction.

And I think it is important in the context of what we heard this morning to note that if the Soviets really believed that the United States would launch a preemptive strike, it would seem only logical that they would protect those ICBM assets with an ABM system. They have not chosen to so. Instead, they have chosen to put their AMB assets around the targets that we would pick or have said we would pick on a second strike mutually assured destruction philosophy.

Now, it is nice to think, to base your assumptions on what you think the Soviets may be thinking in their policy discussions, but the fact remains that they have not chosen to implement a policy that assumes a U.S. first strike at any time.

PREPARED STATEMENT

Mr. Chairman, I would ask that my statement in its entirety be placed in the record, and I would go then to list the items that we think are important as an alternative strategy and upon which the cost figures you have seen are based.

[The statement follows:]

PREPARED STATEMENT OF HON. HARRISON SCHMITT

U.S. SENATOR FROM NEW MEXICO

Mr. Chairman, U.S. foreign and defense policy has been based on the policy of Mutual Assured Destruction (MAD) for far too long. It is a policy which is wrong militarily, wrong politically, and most importantly, wrong morally. It is also a policy which is not accepted by our principle adversary -- the Soviet Union. We must use our technology to move forward a policy of protection rather than one of destruction. We must move forward so that weapons of mass destruction become absolete in the fact of advanced non-nuclear technology and strategy.

The Soviet Union has continued to build its military forces, especially its strategic forces, beyond any reasonable definition of self-defense requirements. More important is the kind of build-up which the Soviet Union has undertaken. The Soviets have concentrated on large land-based ICBMs with a hard-kill counterforce capability. This capability would not be needed if the Soviet Union accepted the policy of Mutual Assured Destruction.

Even more convincing about Soviet intentions is the information available about their defensive programs. First, the Soviet Union has pursued a major civil defense program which could protect both their population and industry. Secondly, unlike the U.S., the Soviets have pursued Anti-Ballistic Missile work to the limits of the ABM Treaty, if not beyond those limits.

The Soviet Union may be close to a ABM breakout capability which would be used to protect "soft" countervalue targets, and not "hard" counter-force targets. This clearly indicates that the Soviet Union is not expecting a first-strike by the United States. In other words, the Soviets are rapidly approaching a first-strike capability with a defense against a U.S. second-strike against their cities and soft targets. The Soviets are pursuing a warfighting strategy while the U.S. is still pursuing the policy of Mutual Assured Destruction.

Mr. Chairman, it is imperative that we formulate a policy based on defending the U.S., our allies, and our interests around the world. The MX missile in the Multiple Protective Shelter (MPS) basing mode fails to do that. It fails because it is, inherently, a continuation of MAD and because it will require so much funding during the next decade that we will be unable to undertake the types of programs needed to defend the U.S.

Any strategic plan for the eighties and nineties must meet certain requirements. First, it must address the Soviet threat to the U.S. and the free world. Secondly, it must be technically feasible. Thirdly, it must be cost effective. Fourthly, it must be politically acceptable to the American people. Lastly, it must be an integrated plan based on a sound world-wide strategy.

We submit that the strategy must be to move out of the period of vulnerability as quickly as possible and to move toward a capability of defending U.S. military, human, industrial and economic assets as well as those of the free world.

Before detailing the alternative to MX-MPS which Senator Roth and I are proposing, let me touch on one more issue. Today and throughout much of the eighties, we are faced with econimic problems at home which will not permit us to do everything in the defense area which we would like to do. We, therefore, must choose carefully the programs which we will pursue. It will be a difficult balancing act to achieve the correct mix of immediate procurement and longer-term research and development. It would be just as wrong to cut the R&D budget for future weapons and technology as a trade-off for procurement today as it would be to cut today's procurement for the benefit of "paper weapons" of the future.

The answer to the delemma of quality versus quantity, weapons today versus better technological weapons tomorrow is the model which the Soviets have established. We must field weapons as soon as they are available and upgrade them in the field. A course of evolution of weapon systems rather than revolution of weapon systems provides us with both short-term and long-term capability. The program which we are advocating follows such a course. It also allows us to build upon a foundation. The ballistic missile defense program we advocate is an example of the approach. It will establish one layer of defense to be followed by another, and later still another.

Mr. Chairman, we advocate that the U.S. --

(1) accelerate the deployment of the MX missiles and to place them at least initially into Titan and Minuteman silos;

(2) upgrade our Minuteman ICBM force and improve its survivability against a Soviet first strike;

(3) upgrade the navigational accuracy of our ballistic missile submarine force to improve the on-target effectiveness of our sea-launched ballistic missiles (SLBM's);

(4) deploy the Trident II SLBM which will have a hard-kill, counter-force capability;

(5) improvement in our communications systems, particularly ballistic missile submarines;

(6) deploy sea-, land-, and air-based cruise missiles as rapidly as possible;

(7) improve our early warning systems;

(8) accelerate anti-ballistic missile (ABM) research and development within the terms of existing ABM treaties; and

(9) accelerate research on air- and space-borne anti-booster technology utilizing our technological lead in this field.

All of these programs address the threat we are facing today. In fact, they begin to address that threat, as the chart indicates, sooner than the MX-MPS program. The Minuteman Missile force is upgraded sooner with more re-entry vehicles available for a response even after a first-strike. The MX missile with 10 warheads is fielded sooner. Our early warning system is upgraded and substantially enhanced much sooner than current plans call for. The result of this particular enhancement is that the President then has the flexibility to launch on warning. This capability will serve as a short-term deterrent until other systems come on line.

Virtually all the programs are technically feasible. The only programs which can be termed "exotic" in any sense are the laser programs. These, however, may not be as exotic as they seem. With the engineering work and program planning the Senate mandated this year, we will have a better idea of the cost and time-frame that these weapons require.

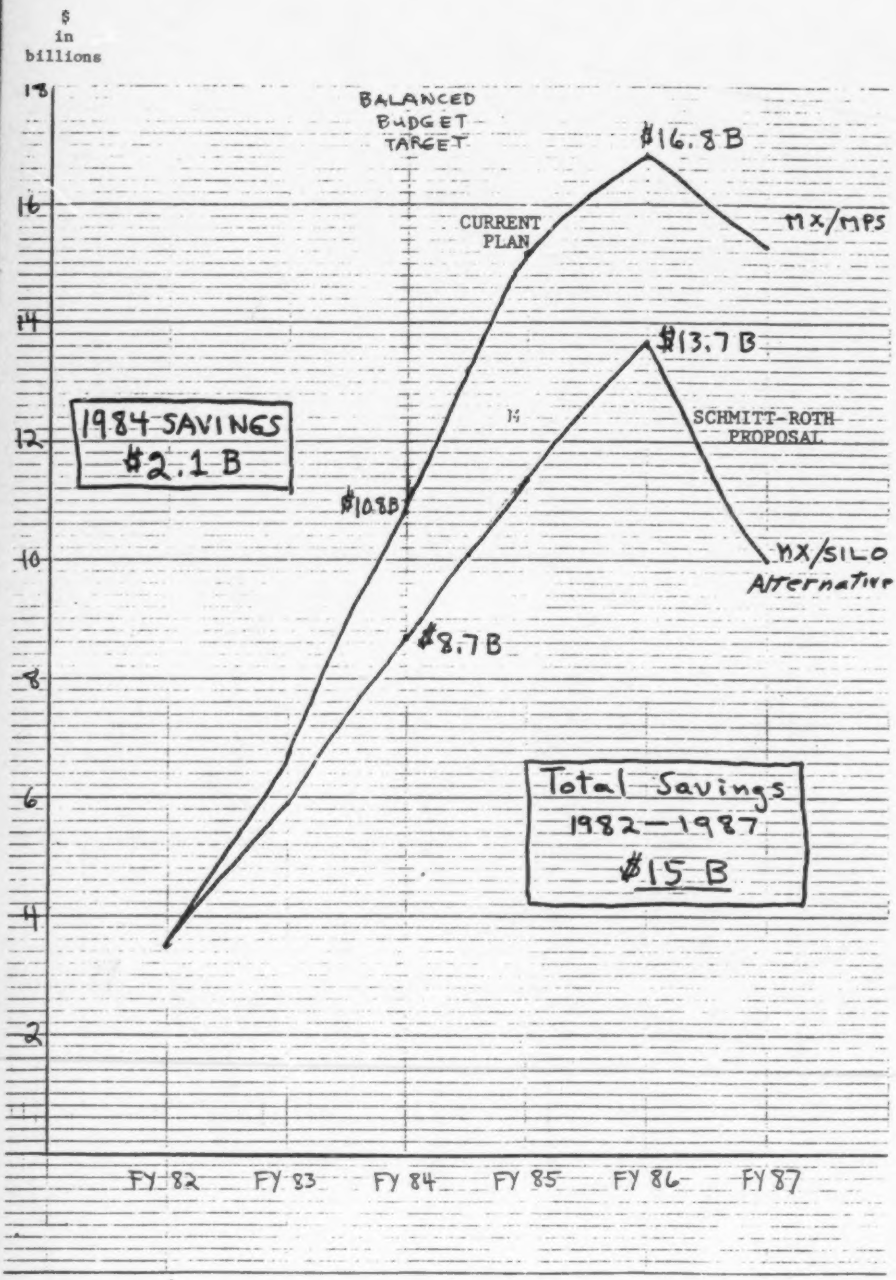
The programs are cost effective in that they address more of our strategic shortfalls. The savings from not pursuing MPS provides for the acceleration of other strategically needed programs in the area of early warning, C3 intelligence and upgrades. In addition, a savings is realized throughout the eighties which can be used for conventional programs, manpower needs or the rebuilding of our economy through cuts in spending.

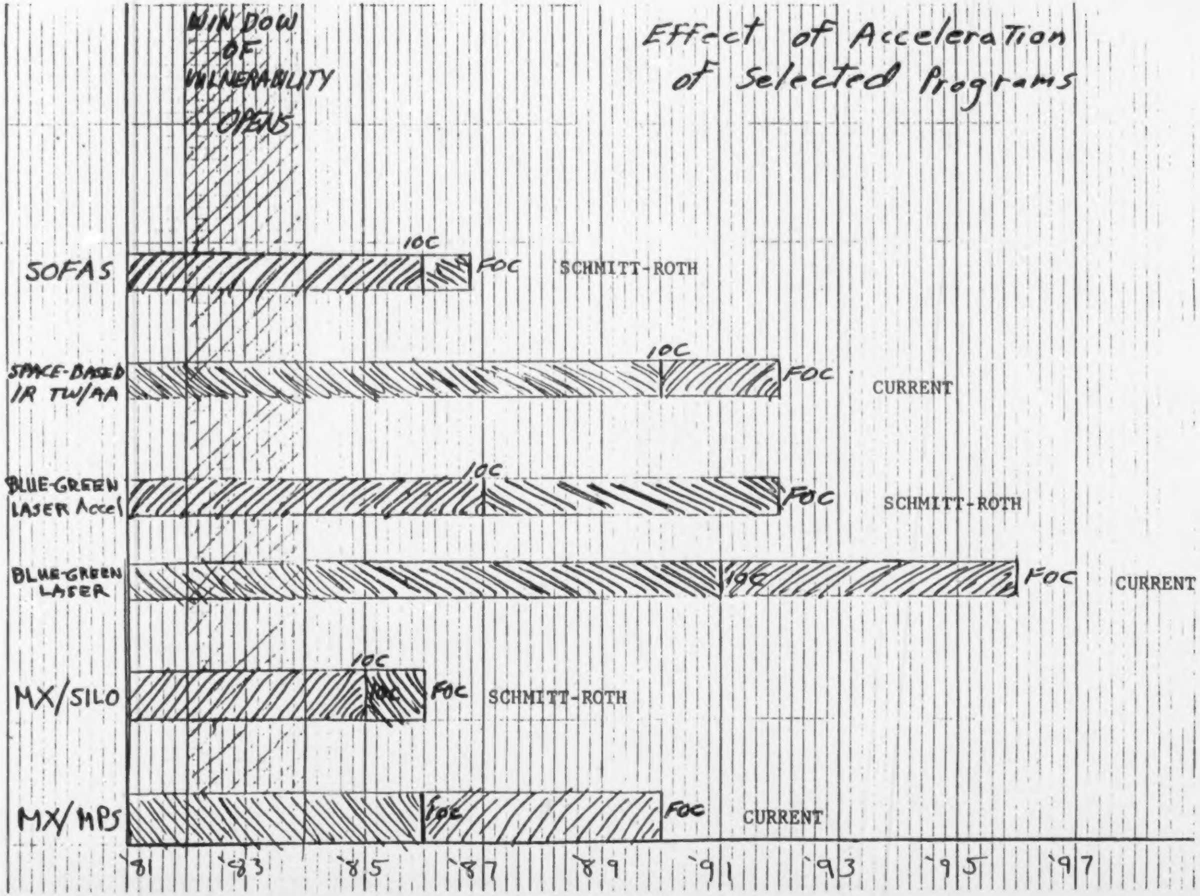
It is politically feasible in that it will not generate the opposition which MPS already has. The tearing up of the nation's west will never be popular. This is especially true for a deployment plan that makes little sense to many Members of Congress and to the American public.

Lastly, we will reverse the trend of robbing Peter to pay Paul. We all know that programs end up costing more than we budget for them. The result has been that programs go underfunded in the out-years and are cancelled or stretched out well beyond when they are needed. The defense budget over the next few years will be and must be tight. This alternative provides necessary flexibility within the framework of the defense budget and the federal budget as a whole.

This alternative will also begin forcing the U.S. to pursue a policy of defense rather than Mutual Assured Destruction. LoADS, followed by an overlay system, finally followed by air and space-based lasers offer the opportunity to defend not only our ICBM's but also other potential targets including our civilian population. Additionally, some of the savings from this alternative can be used to implement a realistic civil defense program.

In conclusion, Mr. Chairman, MPS deployment is not a good program for the MX. It is too expensive, it does not address today's vulnerability problem until the next decade, it is politically unacceptable to large numbers of American people, and it will prevent us from doing what needs to be done in other systems and in R&D. The alternative which we are presenting allows us to re-build our strategic defense posture while simultaneously moving toward a balanced budget in FY 1984.


$ in billions
18
16
14
12
10
8
6
4
2
BALANCED BUDGET TARGET
$16.8 B
CURRENT PLAN
MX/MPS
$13.7 B
SCHMITT-ROTH PROPOSAL
1984 SAVINGS $2.1 B
$10.8B
MX/SILO Alternative
$8.7B
Total Savings 1982—1987 $15 B
FY 82
FY 83
FY 84
FY 85
FY 86
FY 87



Effect of Acceleration of Selected Programs

REBATE ON COST FIGURES

Senator SCHMITT. Now, clearly any cost figures that move out a few years or even in 1 year are subject to some considerable debate. What we have done is receive some preliminary, very rough figures from the Office of the Secretary of Defense, upon which we have based these totals. We would expect those numbers to change. I think the important general statement to make about the cost is that they almost certainly are no more than what we are dealing with with an MPS basing system and other mix of capabilities, and very probably are less. But more importantly, if I could have the second chart, I will show you what we have done with our proposals which are shown in the blue, I will again list them in a moment, and the accelerated availability of certain capabilities during this period of time when the window of vulnerability opens.

Again, as I go through this, maybe Eugene will point to the items that are specifically summarized here on this chart.

We would advocate, Mr. Chairman, that the United States first accelerate the deployment of MX missiles and to place them initially into Titan and Minuteman silos, or into new silos, if that appears to be the most cost-effective way of increasing our total capability.

Second, to upgrade our Minuteman ICBM force and improve its survivability against a Soviet first strike by a variety of measures, some of which are already enacted by this committee, but not nearly at the rate at which I had hoped a few years ago when we started that effort.

Third, upgrade the navigational accuracy of our ballistic missile submarine force to improve the on-target effectiveness of our sea-launched ballistic missiles.

Fourth, deploy the Trident II SLBM which will have a hard-kill counterforce capability.

Fifth, improve our communications systems, particularly those with our ballistic missile submarines. This is tremendously important in any broad strategic policy. If there is anything that has shown up to be vulnerable in our whole strategic system, it is our communication system and particularly those with our ballistic missile submarines. There are some single-point failures in that, and we must do something about that, and do that very quickly. No matter what else we decide to do, we have got to fix that.

Sixth, deploy sea-, land-, and air-based cruise missiles as rapidly as possible and in as large numbers as possible. Even if the Soviets contemplate a first-strike capability, the knowledge that there will be a massive effort launched against them of cruise missiles has to keep them honest to a considerable degree more than they are being kept today.

Seventh, improve our early warning systems so that we can at least discuss the option of a launch-on-warning effort. If there is one way to close that window instantaneously, it is to have a reliable launch-on-warning system, but that takes new, much more certain hardware and analytical capability than we have today.

Eighth, accelerate antiballistic missile (ABM) research and development within the terms of existing ABM treaties, if in fact those treaties are not abrogated in the very near future by the Soviet Union. Clearly there are strong indications that they may be contemplating just such an abrogation of those treaties, and you have heard some of that evidence presented this morning.

And last, accelerate research on air and spaceborne antibooster technology utilizing our technological lead in this field. And I say last, but I think probably in terms of the moral implications, the philosophical implications of what we are talking about today, that may be the most important, as the Senator from Delaware has said, we must leapfrog the whole technology of mass destruction and begin to take the initiative in making these weapons obsolete.

ELIMINATION OF WORLDWIDE NUCLEAR THREAT

I know the President is extremely concerned about this issue. He and I have talked about it. Many others are increasingly talking about the human obligation that we have to begin to put some of our resources, some considerable amount of our resources into removing this sword that hangs over the head of the human race at this time.

Mr. Chairman, if there are any questions, I would be happy to answer them. There is some expansion of this information in the testimony that I will submit for the record.

STATUS OF ABM TREATY

Senator **Garn**. Jack, first let me say, as you well know, I have agreed that we should be developing an ABM system for a long time. Malcolm Wallop and I have tried for 2 or 3 years to get additional money into R. & D. for an ABM system, but I would assume that you would agree that the ABM treaty either needs to be scrapped or modified.

Senator **Schmitt**. I don't think there is any question about it, but even without abrogating the treaty, there is a great deal that we can do. I suspect that will be a moot point within a year or so, depending on what the Soviets finally decide to do.

Senator **Laxalt**. And our own review.

Senator **Schmitt**. And our own review. It is up for renegotiation. But still, within the ABM treaty there is a great deal that we should have been doing and could do today and have chosen not to do, at least not at the pace that we could have pursued. That is what disturbs me most, that we have not even provided for our own defense within the limits of that treaty as it was negotiated.

Senator **Garn**. Well, to show you how naive we are and we continue to be so—and General Rowny is here, and he knows far more about this than any of us because he was there, but it is interesting just briefly what we thought the ABM treaty would do for us, and I have never understood how it was more destabilizing to protect ourselves than it was to build more weapons systems.

But Senator Jackson and Melvin Laird, the Defense Secretary back in 1972—

> Senator **Jackson**. The intent of the agreements is to enhance our security by enhancing the survivability of our deterrent. So you would view Soviet behavior that threatens the survivability of our deterrent as a violation of the intent of the agreement.

> Secretary LAIRD. I would agree.
>
> Senator JACKSON. If there is a pattern which threatens the survivability of our deterrent, you would treat that as a violation of the intent of the parties in making this agreement, would you not?
>
> Secretary LAIRD. I certainly would.
>
> Senator JACKSON. An aggressive program beyond modernization to deploy silo-killing warheads which threatens the survivability of our Minuteman force, aspects of our deterrent force, you would treat that in the same way?
>
> Yes, sir, and would recommend action if such a program were developed and tested.

Well, it goes on and on and on.

And we have got the SS-17, SS-18, and SS-19, and they have done all of those things, and we have sat back through two or three administrations, patting them on the nose and saying, well, we don't really consider those violations.

WEAKNESSES OF ABM TREATY

This was a discussion at the time that it was passed, and how incredibly dumb can we be? They wanted an ABM system to prevent us from building one, or an ABM treaty. That is exactly why they did it. So I don't know how it could fit, the responses of that administration, at least at that time. If they have violated it, forgetting the testing of SAM-5 radars in an ABM mode, battle management mode, they have violated it over and over again, according to this.

And of course Chairman Fulbright at the time didn't agree, saying that well, you are entitled to your opinion. The Soviets have not gone for a first strike capability, and on and on. Maybe we ought to ask Senator Fulbright, if he still sticks by that particular testimony.

But another important thing here, responding to Ambassador Smith at the time, who said the reasons for the ABM treaty,

> The ABM treaty limits the deployment of ABM systems to low levels, alleviating possible Soviet concerns the U.S. safeguard system might have grown to such a level that Soviet deterrent capability would have to be threatened.
>
> Two, the arguments can serve to enhance the apparent Soviet policy of seeking improved overall relations with the United States.

And Secretary of Defense Melvin Laird, July 24, 1972:

> These arguments have a degree of mutuality to them. We are stopping our momentum in the ABM field. They are stopping their momentum in the offensive weapons area. They must be considered together.

Well, they haven't been considered together. We stopped our ABM, we stopped deployment of Minutemen and Titan, at 1,054 in 1969, and haven't deployed any more. How can anybody look at what went on at that time and say that the Soviets haven't gone far, far beyond modernization with the largest expansion in the history of mankind in any weapons system, violating every spirit or intent of SALT I and of the ABM treaty. I just give you that without going into any more detail. I see no reason to continue the ABM treaty at all. As far as I am concerned, it has been violated by the Soviets continuously and systematically and deliberately since the day it was signed. It is absolutely meaningless.

LACK OF ACCOMPLISHMENT IN SALT TREATIES

SALT I accomplished absolutely nothing, and we are living in a dream world if we think the constraints of SALT II made any difference. This morning our testimony was [deleted] warheads. They can build [deleted] warheads if SALT II were in effect. They can build that many legally within the terms of the treaty.

So I have no problems with modifying or just saying we don't have an ABM treaty anymore. You have violated it. And I see no merit, no merit whatsoever in not proceeding with an ABM system. It seems to me it is the correction of the mistake that we made 9 to 10 years ago. It is time we wised up and used our hindsight and went ahead with one.

Senator **Schmitt**. I certainly think we can proceed, Senator, to rectify those deficiencies, and do it in a much more rapid sequence than has been testified to generally by the Department of Defense. Although I know we have some major problems in getting weapons systems on line as rapidly as we used to be able to, still we have got to work to fix those and at the same time utilize our technology in the strategic field, to leapfrog what the Soviets have done and are doing.

In the conventional field and in certain aspects of the strategic forces, I think we had better take a lesson from the Soviets, and that is take something that works, upgrade it, make it work better while we at the same time move to protect ourselves in the future.

Senator **Laxalt**. May I ask the No. 1 fiscal watchdog a question?

ADDING MX MISSILE TO MINUTEMAN SYSTEM

In your $15 billion figure during the period from 1982 to 1987, does that contemplate stuffing Minuteman with the MX missile without additional holes?

Senator Schmitt made reference to the possibility of having to go to additional holes if you want the Minuteman. This is without going to additional holes?

Senator **Roth**. I believe that's right.

Senator **Schmitt**. Yes, this—no, I just added that as a relatively low cost.

Senator **Laxalt**. OK.

I just came back, as did many others, from a trip to Europe, and any reference there to ABM sends a shudder through the whole NATO community, on the basis that that would be a clear signal to our allies that we are going to put in some kind of Fortress America situation here and abandon them.

What is your reaction to that, Senator Schmitt?

Senator **Schmitt**. Well, my reaction is that it is an unfounded fear, I hope. I certainly see no sentiments within this administration or any previous administration, or with anybody who has any philosophical influence over U.S. strategic policy, that we could ever afford to abandon Europe or any other free or potentially free nation of the world. We are a maritime nation. We are not a continental nation, even though we acted like it for 140 years. It is now clear, if it never has been before, that we are dependent, clearly dependent on trade with the rest of the world, and we are dependent in large part on our national defense with the rest of the world.

I think that is unfortunately an assumption that some of the leaders in Europe and those who would be leaders in Europe try to foster. I see no basis for it, in fact.

MX DEPLOYMENT IN EUROPEAN THEATER

Senator **GARN**. Wouldn't it seem to you that a survivable MX would be the best defense for them as well? I don't understand their logic in that at all. If we can have our MX survive, that enhances their security. It is too logical, I suppose.

Senator **LAXALT**. They seem to bifurcate our situation with their theater problems.

Senator **ROTH**. If I could just make a comment, I recently attended a conference in Brussels sponsored by Georgetown Center of Strategic Studies. I will be frank: One of my concerns is that I don't think the Europeans or the Japanese are facing realistically the problems of the 1980's. I feel very strongly that as we are building up our defenses with our limited resources—and they are increasingly limited as we are trying to turn the economy around—that there is a need for the European leaders as well as the Japanese to recognize that they are going to have to share a greater portion of the burden.

While I was there, there was a great deal of discussion about neutralism and Fortress America and so forth. I think that all of us have to realistically face the fact that NATO has to be updated to the problems of today, that the United States cannot be expected to alone bear the burden of meeting the challenges of the Soviet Union, not only within Europe, but elsewhere, so that I think there is a need, Mr. Chairman, for some very candid exchange of discussions in these areas.

Senator **LAXALT**. I suspect they are in being.

Senator **ROTH**. So do I.

Senator **LAXALT**. Some of them I think have already been conducted.

Any more, Senator Garn?

We thank both of our colleagues.

Senator **SCHMITT**. Thank you, Mr. Chairman.

Senator **LAXALT**. The material is in the record.

Thank you.

SUBCOMMITTEE PROCEDURE

Now, gentlemen, we can either go back to Air Force or go to General Rowny for a couple of minutes to discuss arms control ramifications of MX, or however you want to do it.

General?

General **BURKE**. It is your call, sir. It depends on your time. The next Air Force briefing was to review the status of the MX program and the work that is under way. We could do that now, or you might prefer to go right to General Rowny.

U.S. ARMS CONTROL AND DISARMAMENT AGENCY

STATEMENT OF LT. GEN. EDWARD L. ROWNY, RETIRED, CONSULTANT, U.S. ARMS CONTROL AND DISARMAMENT AGENCY

ACCOMPANIED BY:
THOMAS GRAHAM, JR., GENERAL COUNSEL, USACDA
VICTOR E. ALESSI, USACDA
LT. COL. SAMUEL J. WATSON, SPECIAL ASSISTANT, USACDA

ARMS CONTROL IMPLICATIONS OF MOBILE ICBM SYSTEMS

Senator **Laxalt**. I think we will go right with General Rowny because I don't think it will take that long because he is going to be confining his testimony to a very narrow area, pursuant to our agreement.

General **Burke**. I am sure that General Rowny has plenty on his plate right now.

Senator **Laxalt**. We welcome Gen. Edward Rowny as a witness to this committee, upon request of the committee, incidentally, because one of the incidental factors that we have to consider here is the effect of arms control, SALT I, SALT II or whatever on this whole program of MX and basing mode.

General Rowny, we welcome you to the subcommittees. Proceed in any fashion that you wish.

General **Rowny**. Thank you, Senator.

I would like to precede my remarks by adding that I am not here as you know, in any capacity of being nominated by the President as the chief negotiator, and also that the views, therefore, that I am giving are my own and not that of the administration.

Senator **Garn**. Do you think you will make it by the second Reagan administration? [General laughter.]

MPS SYSTEM

General **Rowny**. I am honored to appear before this committee to speak on the arms control implications of mobile ICBM systems. I would like to concentrate on the multiple protective shelter, or as it is called, the MPS system, currently under consideration as the basing mode for the new MX ICBM. I hope that my experience as a SALT negotiator will enable me to shed some light on this important topic.

Let me begin by saying that agreements on strategic arms limitations we enter into should enhance national security and lessen the likelihood of a nuclear war, or nuclear coercion by the Soviets. Arms control agreements should enable us to enhance our ability to deter nuclear war and to restore stability in times of crisis.

SURVIVABILITY OF U.S. STRATEGIC FORCES

In order to achieve such deterrence and stability, it is essential that the strategic forces of the United States be made survivable. Thus, no arms control agreement entered into should reduce the survivability of our strategic forces.

The United States has structured its strategic forces into these three major categories, as we all know, often referred to as the strategic triad. These are the ICBM's, SLBM's, and heavy bombers. Currently, the survivability of the land-based ICBM leg of the triad is in jeopardy. This problem results from the high accuracy and throw-weight capability of Soviet ICBM's, particularly their heavy ICBM's. And it is generally recognized that over 90 percent of our ICBM's could be destroyed in the event of a Soviet attack, even if the Soviets used only a small fraction of their ICBM's and held their remaining land-based missiles in reserve. To restore survivability to the land-based leg of our triad, a number of basing modes for the new generation MX ICBM are currently being considered, and the most promising being the multiple protective shelter system.

LEGALITY OF MPS BASING SCHEME UNDER SALT II TREATY

Because the vulnerability of our fixed ICBM's is inherently destabilizing, the survivability we seek by the proposed MPS basing mode is completely consistent with our arms control objectives. However, there appears to be some question as to whether the MPS basing scheme is consistent with the terms of the unratified SALT II treaty.

In addressing this issue, I would like to remind the committee that the administration is reviewing our SALT policy and has not yet reached a decision on the specifics of its approach to SALT. Therefore, you should not interpret my comments as approving the SALT II treaty. Rather, my comments are intended to illustrate how I view the relationship of the MX-MPS to the relevant provisions of the treaty. Additionally, you are certainly aware that the U.S. Government is in its final stage of its review, via the Townes Commission, of the desirability of the MPS system as a means of coping with the Soviet threat to our ICBM.

Now, according to the provisions of the SALT II treaty, once the protocol expires on December 31, 1981, there will be no limitations on U.S. flight testing or deployment of mobile missiles. Article I of the protocol bans the deployment of mobile ICBM launchers or the flight tests of ICBM's from such launchers. But once this protocol expires there will be no constraints on mobile missiles.

Furthermore the treaty itself in the second agreed statement to article II.1 of the treaty explicitly permits mobile ICBM launchers after expiration of the protocol. I take some pride in this agreed statement because I worked hard during many months of negotiations to insure that this be included and thus protect our right to deploy mobile ICBM systems in an MPS system. To me there is no question that we have a right to deploy mobile ICBM's.

Senator LAXALT. Any question in the minds of the Soviets, General?

General Rowny. Yes, sir, and I will come to that, particularly under the verifiability aspects.

Senator Laxalt. All right.

SOVIET OPPOSITION TO MPS DEPLOYMENT

General Rowny. However, there is some concern about whether the Soviets would agree that the MPS system we adopted would in fact be permitted under the provisions of the treaty. For example, there is a ban on new fixed ICBM launcher construction. There is a ban on storage facilities at launch sites. And there is a ban on deliberate concealment measures which impede verification of the provisions of the treaty.

The United States has stated that the MX missile and the MPS system meet the letter and the spirit of each of these provisions, and the Soviets have been so informed. As I mentioned earlier, mobile missile launchers themselves are consistent with the SALT II provisions under article II which states that after the expiration of the protocol mobile ICBM launchers come under the same limitations applicable to all ICBM launchers.

I might note, however, that we should not be surprised if the Soviets disagree. This is to be expected. However, I believe we should never seek their permission to deploy strategic systems which we need and we know are consistent with our arms control commitments.

VERIFIABILITY OF MX DEPLOYMENT

Therefore, the deployment of the mobile ICBM's per se is not a real issue as far as arms control limitations are concerned or as far as U.S. plans are concerned. The arms control issue involves the verifiability of the deployment of the MX in the MPS basing mode.

The verifiability of its provisions is an essential ingredient of any agreement we enter into. Yet the entire problem of getting the Soviets to cooperate on verification is a vexing one. This is because of the differing nature of our societies. Because we are an open society, the Soviets in fact do not need to worry about verification. Their closed society makes verification, on the other hand, a difficult problem for us. This would be easily solved by on-site inspection, but the Soviets from the beginning of SALT negotiations have steadfastly opposed any mention of on-site inspection. In fact, they have only grudgingly agreed to undertake certain cooperative measures which would assist verification.

Thus, a major objective in the construction of such a verifiable ICBM system is to establish precedents which could be cited if the Soviets deployed a similar ICBM system in the future. If we make certain any system we adopt is verifiable, we will more readily be able to insist that the Soviets follow the same rule.

PROBLEMS WITH VERIFICATION PROVISIONS

The main problems of verification provisions is that the Soviets may not agree with us, despite their actual need for verification, that the steps we take to insure that our system is verifiable are adequate. There decision will be a subjective one. In other words, they will decide for themselves, based on their own interpretations. For example, on June 17, 1979, Soviet Defense Minister Ustinov reportedly told our Secretary of Defense Brown:

> I would like to hear your explanation of these reports of various basing modes such as tunnels and multiple ICBM launchers and the possibility of verification by national technical means. I must however tell you that we cannot agree with such ICBM launcher deployments.

And again he said:

> Such deployments are unacceptable and we cannot agree to them.

Now, Secretary Vance and Ambassador Earle testified——

Senator **Laxalt**. Let me ask you something there.

General **Rowny**. Yes, sir.

Senator **Laxalt**. If that is their stated position, and it has been my understanding that it was, and in view of the Carter position, how did we get so deeply into MX consideration when it was plainly unacceptable to the Soviets?

General **Rowny**. Well, as I say in the next sentence, Secretary Vance and Ambassador Earle testified before the Senate Foreign Relations Committee that by initialing the SALT Treaty the next day, that this meant that the Soviets agreed that our verification provisions were adequate. In other words, it was an assumption.

Senator **Laxalt**. You mean it was resolved in some fashion?

General **Rowny**. It was resolved in Secretary Vance's and Ambassador Earle's mind by the fact that if they didn't agree with us, that they would not have initialed the treaty.

Senator **Laxalt**. I see.

General **Rowny**. Now, that may or may not have been so. They may have initialed it for other reasons and may have put this one aside.

Senator **Laxalt**. Or it could also mean that Ustinov had the reservations which weren't shared by the policymakers who initialed the agreements.

General **Rowny**. It could have been that.

But I think the important point is that there is nothing to prevent the Soviets from raising similar doubts about any future MPS system that we may adopt, and I think that is the main reason for my citing this.

Senator **Laxalt**. Well, how important is that?

General **Rowny**. Well, I think it is quite important because if the Soviets were to go to a mobile system and there were no verification and we permitted that under a treaty, we would be extremely vulnerable.

Senator **Laxalt**. The evidence indicates that is precisely where they are going, doesn't it?

General **Rowny**. Well, there is some evidence on that, sir, because they are doing that with their MRBM or their SS-20 and therefore they are getting a lot of experience in it.

There is no evidence that they have really done this yet in the ICBM mode.

VERIFICATION OF SUBMARINE-BASED MISSILES

To verify a future MPS system it is not necessary to build a basin system allowing the Soviets to monitor the location of every individual missile at all times. As with the verification of submarine-launched ballistic missiles, it is not necessary to know where the submarines are at all times but only how many submarines there are and the number of ballistic missile tubes each has. Such verification is achieved through national technical means by observing the shipyards, construction sites, and submarine launchings. U.S. adherence to ICBM launcher limits can also be verified with comparable confidence because the large size of the MX system and the length of time it takes to assemble and move such a system to its launch site provides ample opportunity for verification.

Now, as I mentioned earlier, the administration has not yet completed its extensive review of ICBM basing options. Therefore, we don't know what option they will recommend. Nevertheless, I do know that there are no easy answers to the problem the Townes Commission is analyzing. Some would suggest that moving our land-based forces to sea would solve the problem of ICBM survivability. However, in my opinion such a move would create new problems. Instead of a strategic triad, we would now have a diad. We would lose some of the redundancy of our strategic forces. Our command and control would become less robust, flexible and responsive.

A sea-based MX would not have the same accuracy against hard targets, not at the present time.

Finally, the decision to deploy MX at sea would have implications for the modernization of our land-based theater nuclear forces in NATO.

MOBILE ABM SYSTEM

I am sure that all of these considerations have been taken into account during the review, or are being taken into account.

Some have suggested that the MPS system for the MX should be protected with a mobile ABM system. Such ABM deployments would require a change to the ABM Treaty which now bans mobile ABM systems. Similarly, a fixed ABM system which called for larger numbers of launchers and radars than now permitted by the treaty would require renegotiation. Aside from any considerations about whether such changes would be in the net U.S. interest, the consequences could have serious implications for the nuclear forces of two of our close allies, the United Kingdom and France. And these factors will certainly be considered in our ABM Treaty review.

If this administration allowed itself to be forced away from increased dispersion of its ACBM's and forced into the far simpler placement of MX missiles in current Minuteman silos and not in some way proliferate the number of aim points, in my opinion we would gain little and lose a lot. Having concentrated our most potent force of hard-target killers in known positions, they could be easily destroyed by a Soviet first-strike. It would probably require us to go to a declaratory policy in launch-on-warning which I do not believe would be prudent.

In short, the flight testing and deployment of the MX missile in a mobile basing mode will be permitted by the terms of SALT II after the protocol expires on December 31 of this year. However, there are some arms control problems concerning the multiple protective structure basing mode with regard to verification. Nevertheless, if we choose a basing mode that is verifiable, we will be acting in consonance with the provisions of the SALT II Treaty which we and the Soviets have initialed.

Mr. Chairman, I have tried to confine my remarks to what is in the treaty and the protocol and the implications to SALT and the ABM Treaty and have not gone beyond that in this statement. I will be happy to try to answer your questions.

SALT PROBLEMS ELIMINATED BY OVERCOMING VERIFICATION

Senator **Laxalt**. In essence, what you are saying is after the protocol expires at the end of this year, if verification can be overcome, the problems of verification, there are no SALT problems in terms of SALT I or the initialed SALT II.

General **Rowny**. That is fundamentally it.

Senator **Laxalt**. Is that what you are saying fundamentally?

General **Rowny**. Fundamentally, yes, sir.

Senator **Schmitt**. Mr. Chairman, could I get one thing clarified before there are any other questions?

Has this administration developed some legal position about the status of the SALT II treaty? I mean, I can understand looking at it to understand what the Soviets might agree to or not agree to in the future, but every time I turn around here and elsewhere, it is as if we are assuming the SALT II treaty is a treaty.

General **Rowny**. Well, the statements that the administration has made on this are that there is no legal or moral obligation to abide by the SALT I interim agreement or SALT II. However, so long as the Soviets do not go beyond the terms of the SALT treaty, we will also abide by the terms of the initialled SALT treaty, and there is a disclaimer that, however, if at some point doing so would interfere or impinge upon our national security, then we would take another view of the situation.

TREATY VIOLATIONS

Senator **Garn**. General, what about the violations, though, not only what I described to you today as Senator Jackson understood it, Secretary Laird and others, but what about the encryption of telemetry recently? I mean, they violate it every day but we say they don't. Officially they have not violated it, therefore we don't do anything.

General **Rowny**. You are absolutely right, Senator. At the time we went into the ABM treaty and the ICBM freeze, we traded off. We gave them the ABM treaty because they knew we were ahead. We thought we were getting a freeze. Those two concepts are intertwined, as you well know, and I don't mean to teach you, sir, but I am just explaining the background here for my own clarification.

Both sides have shields and spears. If you throw away your shield, it must be with the assumption that the spears are going to be of equal length, because if one spear continues to grow and your spear is of shorter length, then you either have to get that fellow's spear broken off, or you have got to bring back your shields.

This was recognized at the end of SALT I, and Ambassador Smith made a unilateral statement on instructions from the U.S. Government that in the absence of a satisfactory offensive agreement, the United States would reserve the right to reexamine its going along—what is the word—we would invoke the supreme national interest and we would withdraw from the ABM treaty.

Now, the only other thought that I can add is that the Soviets generally do not abide by what we would consider as the spirit of an agreement. That is a foreign concept to them. They believe that an agreement entered into must be so stated in terms that they abide by the letter, and if you do not have an agreement which binds them to the letter of the agreement, they do not feel bound by the spirit of the agreement.

Senator SCHMITT. Well, that statement sort of makes the statement that you have just given us almost meaningless, because it seems to me everybody over here is still talking about the spirit of the agreement, and then they turn around and give us all of the evidence that the Soviets are violating the spirit of the agreement and we still haven't done anything.

Senator GARN. Well, it goes beyond the spirit of the intent. Aren't there specific violations that we have refused to call them on, like the SAM-5 radars, like the encryption of the telemetering data?

General ROWNY. These again are policy decisions. At what point——

Senator GARN. They remind me of the monkeys sitting there with their hands over their eyes and ears and mouths, and that is what we have done at the Standing Consultative Committee.

General ROWNY. At what point does the Government believe that it is in their interest to in effect throw down the gauntlet? But so long as any of these measures do not jeopardize the entire system, then we try to work them out.

But let me say that where agreements have been so negotiated that the letter ties them down or the loopholes have been closed, the Soviets have generally abided by the letter of the agreement. That is what took so long in SALT II and that is why I made the statement here that if we build some system which has provisions in it and we abide by those provisions, then at least we have a precedent for hoping that they will do the same.

ABM REVIEW

Senator GARN. Well, what was the ABM treaty in 1972 then? Does it provide for amendments, renegotiation, abrogation by one party or another? What is the procedure?

General ROWNY. The procedure is an ABM review every 5 years. We made one in 1977, we will make another one next year. So there are provisions or procedures for review of the ABM treaty, and that is one we will be undertaking.

Senator GARN. Either way, either amendments or changes or total abrogation?

General ROWNEY. Amendments can be made at any time, but the amendments will be specifically looked at, or the treaty will be specifically looked at at regular intervals, 5 years, but we have the right to make amendments at any time.

SOVIET VIOLATIONS OF TREATY

Senator SCHMITT. General, do you know of any examples where in an objective analysis, where it was in the Soviets' interest to violate the letter of the treaty that they didn't go ahead and violate it?

We know they violated the so-called nuclear limitation test ban treaty. Maybe you could supply that for the record.

General ROWNY. When we have called them, for example, in the ABM treaty, when they used the radars for two purposes of the ABM mode, and also for testing new systems, we called them, that this would be a possible violation. They ceased doing that. So again, where the letter of the law is tight and we have called them on the violation or apparent violation, they have ceased and desisted.

Senator SCHMITT. But what did they lose in that case that they might not already have gotten, or found that one test may have been enough to tell them don't do it, or it worked?

They violated it, and you called them on it, and they stopped violating it, but they still violated the letter. They knew what they were doing. I just worry about, pardon the expression, the mind set that has developed that the Soviets don't violate the letter of treaties. They do. They have done it throughout their whole history. It has nothing to do with communism or not. They have violated the letter of treaties throughout history if they thought it was in their national interest to do so. And we shouldn't believe they are going to do anything otherwise.

Now, it is fine to sit around and talk. I don't mind talking. You can negotiate treaties, things like that. But never expect them to adhere to it unless it is in their national interest to do so as they perceive their national interest.

PHASED ARRAY RADAR BATTLE MANAGEMENT

Senator GARN. We haven't even been willing to bring up this phased array radar battle management. That has been going on. Isn't that a specific violation of the letter of the treaty?

General ROWNY. It is being brought up in this particular session. It is being raised in this session. It is a classified item being raised in the SCC.

Senator GARN. Well, I hope so. I wrote a letter signed by many of my colleagues asking the Reagan administration to bring it up.

Senator SCHMITT. Mr. Chairman, I won't pursue this any further, but I think it is important to our deliberations to understand the kind of thoughts relative to Soviet behavior that is guiding at least this level of policy formulation within the administration.

Senator LAXALT. May I ask a closing question, General?

Senator GARN. I have got a couple more questions, whenever.

SOVIET RESPONSE TO U.S. LAND-BASED SYSTEM

Senator **Laxalt**. We had testimony this morning, General, to the effect that so far as the 1980's are concerned, I suppose most of the 1990's, that it wasn't anticipated that the Soviets would be moving into new weapons systems, land-based anyhow; they would simply modify and modernize their existing systems.

What is going to be the effect when it is clear, if it becomes this, that we go MX, that we go land-based? What would be the Soviet response, in your estimation, to that move, if any?

General **Rowny**. Well, the hoped-for response would be that if we go to MX in some multiple protective shelter mode, that the curve shifts so that the rather extreme or great advantage they have now would shift to an advantage to our side.

Senator **Laxalt**. That was demonstrated by General Burke's testimony.

General **Rowny**. Right.

Senator **Laxalt**. But that would presuppose that they would do nothing in response, really, other than what was indicated this morning by way of modernization and modifications to their existing systems.

Would this drive them to a super-MX system of their own?

General **Rowny**. Well, of course, again, our hope is that they would then see the wisdom of coming to terms and begin what we all want, and that is a reduction of the destructive potential.

Senator **Laxalt**. All right, and that is critical. That's critical.

How much do we have to show here to the Soviets that we did not, or at least maybe if we did lose our will and resolve post-Vietnam, that we have recaptured it somewhat? I have never subscribed to the fact that we lost it to begin with, but would a strong vote out of here on an MX system with whatever basing mode, would that be sufficient enough signal to the Soviets so this President could sit down very quickly and work out a realistic arms control agreement?

General **Rowny**. I think that it would help, sir. I don't think it by itself would be sufficient. I think that the totality of what we are going to do in redressing our strategic vulnerability would have to be taken into account.

Senator **Laxalt**. So it is the whole defense package.

General **Rowny**. It is the whole defense package, yes, sir, and the question is——

Senator **Laxalt**. Isn't that the real answer, General?

I don't know, I don't know whether my colleagues share this or not.

Have you looked at those numbers in the 1980's and 1990's? They are terrifying, to say the least. If nothing is done in the interim, it seems to me the only sensible solution so far as we are concerned, as far as the Soviet and the world is concerned is to sit down and hammer out an agreement, and stop this stuff, at least restrain it, make it verifiable. It would save a lot of money, and I think we would stabilize it far more than where we are going.

General **Rowny**. I think the answer, yes, sir, is that we would like to get an agreement, and it has been the policy of several, all the administrations, including this one. The difficulty is how do you impress upon the Soviets that we do have the will and we are going to put in the resources necessary so that curve which is unrelenting on their part, will turn down. And so long as ours is level, only slightly up, they don't appear to believe that.

And until, if, when they do believe that we have that will, I think then they will come to the negotiating table. But without that, we don't have the negotiating leverage, and we haven't taken care of our security. So I don't know any other alternatives.

Senator **LAXALT**. This business would be a lot easier if we didn't have these horrendous leadtimes, wouldn't it.

Senator **GARN**. Mr. Chairman?

Senator **LAXALT**. Senator Garn.

Senator **GARN**. Let me get back to a couple of things.

MPS SYSTEM DESIGNED WITH CONCERN FOR SALT

Do you believe that the original MPS systems was designed with too much concern for SALT considerations, specifically verification?

In other words, the actual design of it, in my opinion, was primarily motivated by the fact they wanted to make sure that the Soviets would verify it.

Do you agree with that?

General **ROWNY**. I think there are certainly a large number of measures that were taken to be sure it was verifiable, but I do not believe that that was necessarily so that they could verify it.

Senator **GARN**. Well, certainly portholes and——

General **ROWNY**. I think it was so that if they mimicked us or went to a similar system, that we could then insist that these were the new rules that they would have to abide by. So I don't think we were doing it simply to allow them to verify us. I think we were doing it so that if they aped us, mimicked us, we could then verify their systems.

Now, there were a great number of these so-called cooperative measures, or not cooperative, but verification measures.

SOVIET MISSILE BUILDUP BASED ON OWN AGENDA

Senator **GARN**. In your experience, all the years you were in Geneva, did you ever feel that the Soviets ever did anything in response to what we were doing, or that they had their own agenda?

It appears to me this buildup over the last 10 to 15 years has been without regard to what we did, that they have an agenda for what they wanted to achieve in offensive weapons systems, and all these negotiations and all these talks have had absolutely no impact on that whatsoever.

General **ROWNY**. I would say as a general statement that that was correct, they do have their agenda. They march to their own drummer. They look at their security first, and then they look at arms control second. And if arms control measures will not interfere with their security or what they want, then I think they enter into agreements.

Senator **GARN**. And hence there is a continuous record of us making unilateral decisions from not deploying more than 1,054

ICBM's, now 1,053, and B-1 decision, many others, that we have unilaterally stopped, and there has been absolutely no reciprocation whatsoever.

I argued that with Paul Warnke. I defied him to show me once, one time, in many conversations, many debates, that when we made a cutback that they followed suit. They have not done so yet.

General ROWNY. Senator, I was reminded here that some time ago I looked at the system that was developed before, an approximately $40 billion cost, $1 billion was put into these verification measures. So we had $1 billion cost in the $40 billion.

CONVERSION OF SS-11 INTO SS-19

Senator GARN. Why didn't we protest the conversion of the SS-11's into SS-19's?

Wasn't that a violation at least in——

General ROWNY. It was a violation of the siprit and the intent. We agreed to launchers, and we agreed to dimensions, the size of these launchers, of these silos, and had we agreed to the original terms that people like Paul Nitze wanted, of throw-weight and the real destructive potential, we wouldn't have gotten into that box. So we limited the wrong thing. We limited launchers, thinking that the Soviets would limit their missiles. They didn't. They just stuffed better missiles into those same holes.

That is one of the examples I was mentioning. They don't abide by the spirit. You have to pin them down to the letter of the law, and then they will begin to——

Senator GARN. The very fact that we limited launchers, holes in the ground, isn't that one of the reasons we have gone to the development of a large missile like the MX rather than smaller, truly mobile missiles?

So hasn't the treaty itself sort of dictated our own development rather than what would have been a more logical and less vulnerable type of deterrent?

General ROWNY. Well, I think that there is some evidence to show that we did have arms control provisions in our minds in building our systems.

Senator GARN. We intend to build a massive missile with 10 warheads, because the treaty only limited launchers. So you stuff it with as much as you can get.

General ROWNY. Yes, sir.

Senator GARN. Would deployment of small, mobile ICBM's be consistent with the goals of arms control as you see them?

General ROWNY. Well, if we were going to abide by the treaty provisions as now listed, then we would want to utilize the best advantages we could under those 1,054 launchers, and just to do a new system would mean renegotiating the treaty or we are going down another tact.

Senator GARN. The treaty is dead. There is no treaty, only in our minds.

General ROWNY. Senator, could I perhaps come back for several minutes with some of the items that have been passed to me here which require some clarification on my part?

Senator LAXALT. Surely, surely. We are coming back in here Wednesday——

General ROWNY. No, no, I mean here in a few minutes.

Senator LAXALT. Oh, surely, you can do that as well.

We are going to be—I am going to try to adjourn this around 4:30. We have a meeting in the White House at 5 so that is a rough time schedule, and if the Air Force doesn't mind, I guess we can work around it.

Is that all right, Kelly?

General BURKE. Yes, sir.

Senator LAXALT. Let's do it then.

Any more questions of the General for the moment?

Senator SCHMITT. Just one.

SOVIET ASSUMPTION OF U.S. FIRST STRIKE

On this question of the assumption—or let me ask two parts.

How important is it for the Russians to assume that we might launch a first strike?

General ROWNY. I think the doubt that it raises in their mind has some great advantage, particularly when we are behind. So I think that as long as we keep them guessing, I think that that is to our advantage, and therefore I think we stand to gain.

Senator SCHMITT. How critical do you think it is to our policy formulation that they believe that?

Does it in any way affect whether we do MPS or not?

General ROWNY. Well, the only way it affects that is that the Soviets, some Soviets, maybe the official Soviets, would believe that by going MX–MPS, we were developing a first strike capability. We know that we wouldn't launch a first strike, but they may believe that we are developing a first strike capability because we have so protected our missiles.

Now, to the extent that that would drive them to a treaty and then we could begin, reducing, I see nothing wrong with that.

So it is sort of an anomaly here that their believing that we are developing a first-strike capability may work to our advantage, even though we know that we are not developing it for that purpose.

Senator SCHMITT. Well, that seemed to be the theme in General Burke's diagrams, but do you know of any hard evidence that they actually objectively believe that the United States would launch a first strike?

General ROWNY. They have made such statements.

Senator SCHMITT. No hard evidence.

General ROWNY. No hard evidence, no, sir. They is no hard evidence.

Senator SCHMITT. The Soviets make a lot of statements.

General ROWNY. They make a lot of statements, yes, sir.

SOVIET PROTECTION OF SOFT AND HARD ASSETS

Senator SCHMITT. Isn't the evidence to the contrary, in that they have made no attempt to protect their hard assets, but they make every attempt to protect their soft ones, their value assets, the ones that presumably would be most vulnerable to a second strike?

General ROWNY. I think they harden pretty much across the board. I think they harden as much as they can afford, and they can afford, and they do a great deal of it.

Senator SCHMITT. Yes, but there is no ABM protection, all of the ABM and civil defense work is related to their assets of value.

General ROWNY. Well, their——

U.S. COUNTERFORCE CAPABILITY

Senator SCHMITT. And we presumably, we have the capability to effect—we have a counterforce capability, do we not, and a first strike counterforce capability?

General ROWNY. We have a counterforce capability which is now limited in the event of a first strike on the part of the Soviets.

Senator SCHMITT. No, if we launched a first strike.

General ROWNY. If we launched a first stike, we don't have as great a capability as the Soviets do. We have a considerable capability.

Senator SCHMITT. But they have made no attempt to protect against them other than hardening.

General ROWNY. Oh, they harden, yes.

Senator SCHMITT. As far as any other?

General ROWNY. Well, the only other thing they could do presumably would be the ABM defenses, and there we have entered into a treaty and they have not gone beyond the treaty except in——

Senator GARN. A few dozen?

General ROWNY. Except in these peripheral.

Senator SCHMITT. Thank you, Mr. Chairman.

Senator LAXALT. General, why don't we permit you to take a bit of time, and when it is appropriate and you are ready, let us know and we will cut into the Air Force testimony.

Is that all right?

General ROWNY. I would appreciate that very much.

DEPARTMENT OF DEFENSE

DEPARTMENT OF THE AIR FORCE

STATEMENT OF BRIG. GEN. JAMES P. McCARTHY, SPECIAL ASSISTANT FOR MX, DEPUTY CHIEF OF STAFF, RESEARCH, DEVELOPMENT AND ACQUISITION, DEPARTMENT OF THE AIR FORCE

STATUS OF MX MISSILE PROGRAM

Senator **LAXALT**. All right, General Burke, you may structure the continuing presentation in any manner that you wish.

General **BURKE**. We have a second briefing that was requested, Mr. Chairman, and that was on the status of the MX program itself.

Senator **LAXALT**. And is General McCarthy going to handle that?

General **BURKE**. General McCarthy, our special assistant for the MX will handle that

You might do that very quickly.

If you will just give an indication, we will try to move right quickly through this part and try to answer the questions.

General **McCARTHY**. Recognizing your knowledge already of the MX–MPS system, Mr. Chairman, we decided we would cover these things very quickly for you today.

Our objective has been to retain those unique characteristics of a land-based ICBM and you have already had discussion on that earlier today.

The current design of first of all the missile itself is a four-staged solid propellant with a skirt here. These three stages are solid, and I will discuss their status as far as development is concerned.

VERY LITTLE NEW TECHNOLOGY

The extendable exit nozzle cones, that technology that enables us to stack these stages and compress the size of the missile; a fourth stage which enables us to drop off the boosters, the warheads; the post-boost vehicle reentry module here which is designed to carry 10. It has the physical capacity to carry 12; and the shroud that covers the system.

Senator **LAXALT**. Have there been any fundamental changes or significant changes in design during this past year?

General **McCARTHY**. None that I would call significant. They have all been relatively minor. The hardware that has been tested—and I will show you some photographs—was actually designed as much as 1 year ago, and it is performing very well.

To give you an idea of the size, we have talked about Minuteman III today, and this is a Minuteman III missile on the left hand side. This is an MX missile on the right hand side. You can see the difference in the height, 60 feet versus 70; in the diameter, 66 at this widest point, 92 here. This carries 3 Mark 12A's. MX is scheduled to carry 10 Mark 12A's.

The gross weight is different, 78,000 pounds versus 192,000 pounds.

The MPS system, the basing mode for this new missile is obviously the subject of concern, and what we have done here is taken an artist's concept of a valley in Nevada and Utah and tried to superimpose an MPS system on it. I would point out that this is not to scale, and that the valleys are sometimes several hundred miles long and 50, 70 miles wide. But so that you could actually see these lines, we have drawn them out of proportion.

CLUSTER LAYOUT

This is what we call the designated transportation network, a road that comes from where the missiles are assembled in the first main operating base, down into the deployment area.

This is an artist's concept of a cluster layout, a cluster being defined as 23 shelters with the appropriate maintenance facilities. Each of these shelters is at least a mile apart from its nearest neighbor, and as General Burke pointed out earlier today, there are spaces that have been left to meet the current Soviet threat, which is relatively large reentry vehicle yields, that if the Soviets fractionate, then would be available to fill in with additional shelters that could be accommodated with the lower yield warheads.

This concept shows a oneness, which is for verification purposes, and a barrier that after the missile is introduced into the cluster system, would not permit that missile to come out without being able to verify that the earthen barrier had been moved.

In the largest of the valleys that we have out there, we could get approximately 10 of these clusters, or approximately 230 shelters. There are some valleys that would only have one. So it depends upon the geotechnical suitable area within these valleys. Generally they are required to be away from the mountainous areas, and if there is a play or a place where water sometimes stands, that would not be a suitable area as well.

MPS SHELTER

This is the MPS shelter. Basically it is constructed of a concrete and steel tube, lays horizontal about half above ground and half below ground. The approximate dimensions are 14½ feet diameter and about 170 feet long. The earth that was taken out then to put this concrete and steel tube in there is then covered over.

The approximate size of this area fenced in is two and one-half acres. This would be the land area that would be under Air Force control and withdrawn from Federal land, public land.

The present activities in the area that are now ongoing would be permitted to continue up to the level of the defense. The security system that would be used in the MX is quite similar in concept to the Minuteman security system.

The road, which is a gravel road that connects to the designated transportation network, is put at such a level that we have what we call the loading dock concept. The bottom of the access here is approximately 10 feet above the ground which permits the easy movement of 10 missiles on and off the transporter.

Senator LAXALT. On that point, as you well know, there are a lot of people in both Utah and Nevada who don't believe for a moment that the area withdrawn will only be the two and one-half acre parcels. They contend that you have a mobile system here, it is unlike Minuteman, you are going to be moving this stuff around, and that security considerations will finally dictate that all this be fenced off.

Where are we on that?

Well, that is a troublesome point to this Senator also.

General McCARTHY. Yes, sir.

I would respond in two ways, Mr. Chairman. First of all, I don't know as a military man how to make the security system of the size you have described work.

Senator LAXALT. I don't know either.

General McCARTHY. And second, I don't feel that it is necessary. We have sufficient confidence in our ability to protect that missile in that hardened shelter from discovery of which one has the missile in it, and from the infrequentness of the movement that we don't believe that that will ever be a problem.

Our estimate of the number of times that you would move this missile is approximately three times a year. I think most of the people who consider that, who make the statements that you have suggested, have a concept in which the missile is in constant movement, which we don't really envision.

I would point to our Minuteman experience and suggest that in designing the system we have drawn on that effective security system and——

Senator LAXALT. Well, if you didn't have the mobile aspects, I think they would accept that.

General McCARTHY. Yes, sir.

Senator LAXALT. Well, would we be responsible, if this is where it eventually comes down, would we be responsible in writing into the legislation the type of protection that would guarantee those people's rights to use that remaining land?

General BURKE. We have encouraged that.

Senator LAXALT. Would that be a problem, General Burke?

General BURKE. The Air Force would support such provisions. That seems to me the best way to cover it, to crank it right into the law, not that laws can't be changed but they can't be changed by us.

TRAFFIC CONTROL FOR MISSILE MOVEMENT

Senator SCHMITT. What kind of traffic control would be required these three times a year?

General McCARTHY. Our concept is very similar to the Minuteman concept in which, because there is a possible nuclear weapon in this case, but in the Minuteman there is an actual nuclear weapon moving in convoy, we use State highway patrol or county sheriff people to provide security in front and behind as well as Air Force security vehicles, and the local authorities provide traffic control to make sure that the convoy passes without being impeded by any problems, and we envision a similar type system for this.

COSTS RESULTING FROM USE OF LOCAL OFFICIALS

Senator SCHMITT. Have you estimated the cost to the local officials for working with you on this? How is that all going to be handled?

General McCARTHY. There has been a commitment that is generally all-encompassing that the Federal Government has a responsibility to accept those costs to the State and local communities for MX that are beyond their capability to handle. In addition to that, we have set up working groups within Nevada and Utah, and one of those working groups which is just now getting under way is law enforcement working groups.

Senator SCHMITT. Have you consulted with the White Sands Missile Range people yet because they often have to close off public highways.

General McCARTHY. To my knowledge, sir, we have not.

Senator SCHMITT. You might discuss it with them and see what kind of problems and resentments they have stood up.

General McCARTHY. We will be happy to take that suggestion, sir, and we will do that.

I would suggest that the security problem is different in that the movement would be limited and only in a particular segment of the road, and it actually would be a moving type restriction rather than one that blocks off large areas.

HIGHWAY INCONVENIENCE RESULTING FROM MOVEMENT OF MISSILES

Senator SCHMITT. But it is still going to be an inconvenience to travelers, right?

General McCARTHY. Yes, sir. If you were proceeding on one of those roads while we were moving the missile, there would be some inconvenience.

Senator SCHMITT. In that regard it would be very similar to White Sands.

General McCARTHY. Yes, sir.

Senator LAXALT. Of course, most of the system that you contemplate is off the existing traveled ways, isn't it?

General McCARTHY. Yes, sir, it is. Most of the area we are talking about does not have much roads in it, as you are well aware. However, we have made the statement that these roads would be available to the public, that there would be no limitation on it. So those people who choose to use it——

Senator LAXALT. But they will be on their own there.

General McCARTHY. Could be inconvenienced.

What we have done is taken an actual photograph in Nevada and superimposed what we envision that the shelters would look like after the revegetation is completed, and we estimate that in this area——

Senator GARN. What do you mean revegetation?

There is no vegetation in Nevada.

Senator SCHMITT. Looks like you overdid it. [General laughter.]

MISSILE TRANSPORTER

General McCarthy. What we have shown here is an artist's concept of the transporter as it draws up to the shelter, and a shield comes out to enclose the access to the shelter so that even if you are standing in the vicinity, you would not be able to see what would happen. Each of the shelters has a concrete and steel mass simulator that weighs approximately the same as the missile itself.

So the first action that takes place after the transporter is in the position here, is that assuming there is a simulator in there, it is drawn out onto the transporter, and then one of two actions can take place. The simulator is put back in and the transporter goes on, or the missile is put back in and the transporter goes on with the simulator. That exchange, then, is aided by the fact that we have a loading dock there and the missile or the simulator simply rolls on and off for ease of movement.

The estimated time, if the transporter is on the cluster road to the time it could pull up in here and complete the action and put the missile in the shelter in an automated process is approximately 6 minutes.

If the system would ever need to be executed, the execution takes less than 2 minutes. The missile canister would come out approximately two-thirds of the way out and at this point would start to cantilever to the upright position. The front end, which was part of the suspension system, would drop off, leaving a tube that then the missile is cold-launched out of and the missile, the first stage actually ignites just after passing the top of the tube, and is on its way to its target.

I have not addressed the communications or any other portions of the program. I would be happy to do that if you have questions.

PROGRAM STATUS

As far as our actual program status, we are in the full scale engineering development, as you know. This is a list of the major contractors that are employed in developing the systems, and I will address some of those as I show you photographs of what has actually been accomplished.

These are the key activities that are scheduled for this year: all motor stages test fired at sea level. We have done that and I will show you some photographs of that. We will do our initial motor test firings in the altitude chambers. We have already completed some 18,000 hours of the centrifuge guidance and control tests at Holloman, and we are about to run the sled test to test the G effects on the guidance and control system.

We are——

Senator Schmitt. Has that sled been refurbished, the track and everything?

General McCarthy. Sir, I can't answer that question.

Senator Schmitt. Wasn't that a problem a year or so ago?

General Burke. They did have some difficulties with it, and I think the answer is yes, but I will double check.

General McCarthy. We have completed the system critical design review, and it appears as though we are well on schedule for the first flight, which is 1983.

We are in the process of completing the final environmental impact statement which is necessary for the decision on where they deploy the system, and that will then lead to land acquisition.

SHELTER CONSTRUCTION

And we have initiated an innovative shelter construction test program at the Nevada test site. Here, using two different methods, we are constructing horizontal MPS shelters, one using a precast, the other a cast in place. Our purpose is to find out ways in which we can reduce the cost, minimize the labor, and automate that process as much as possible.

I was out there and visited that site several weeks ago, and we are in the process of doing the precast at the present time. The cast in place comes a little bit later.

This is a photograph of an actual test firing of stage 1. This is at Thiokol in Utah. We have been quite impressed with the test parameters and suggest that we have met all of our design objectives although there is still further analysis to be done on the systems.

This now has been tested three times successfully.

This is the second stage made by Aerojet in California. It now has one successful test firing. It is on schedule, however, as far as development is concerned.

And this is stage 3, tested at Hercules in Utah. It has been testfired twice now successfully. So all of our ground level motor testing has been completed on schedule and effectively.

This is the guidance and control unit. You see it here immersed in liquid to aid in its construction, to keep out dust and other foreign objects. This system is working most effectively and has flown on an aircraft, and we believe that the accuracy that we have briefed will be met.

This is a photograph of the transporter that is presently on the roads at the Nevada test site. In addition to learning how to operate a vehicle that weights a million pounds or a million and one-half pounds loaded, we are testing the types of tires and the road beds. This is a compacted gravel road bed that is working quite well. We learned after this photograph was taken that smooth tires are better than ribbed tires as far as maintaining the roads is concerned.

Senator LAXALT. Look at the size of those tires in relation to the pickup, Jack.

Senator SCHMITT. It is a little pickup.

General MCCARTHY. This is a little pickup right here.

While this obviously is a very large vehicle, it is quite compatible in driving characteristics and in some ways size with the huge trucks that are used in the mining operations in that area.

We have completed—we are presently training some Strategic Air Command drivers as a test basis to see what we can gain in the experience of young airmen, both men and women, learning to drive this vehicle, and both groups have performed quite well.

There has been quite a lot of discussion of the cost of the system. The figures that I will use are in 1980 dollars, except where I specify then-year dollars.

COST SUMMARY OF R.D.T. & E.

This is the cost summary of R.D.T. & E. at $6.7 billion, procurement at $12.9 million in Mil Con, and I am sorry, I did use 1978 dollars on this chart. This gives you the $28.6 billion which if inflated to 1980 dollars gives you the $33.8 billion which if inflated to 1980 dollars gives you the $38.8 billion.

We believe that the program can be brought in within 10 percent of that which is, I think, quite good for a program of this size and the number of years it extends over.

This is our fiscal year 1980 and prior year funding, the 1981 appropriation here, and the fiscal year 1982 request is approximately $2.5 billion; 1983 is shown here, and this is when we take first delivery on—excuse me, first ordering of aircraft for command and control and the first nine missiles.

Senator **Garn**. General, how can you really anticipate only 10 percent with the way the general inflation rate is going and what has happened to all of these other large procurement programs?

You know, I have been here for 7 years and I don't question anybody's sincerity at the time they made those estimates, but just again, in hindsight, I sat there and watched them just spiral up from ships to airplanes to you name it.

General **McCarthy**. I was responding in constant-year dollars which ignore inflation, and I recognize that that is a major cost driver, but in using the constant-year cost figures, inflation is not a factor in that.

Second, we have got good experience now on the missile components.

Senator **Laxalt**. Can we go back to that then?

General **McCarthy**. Yes, sir.

Senator **Laxalt**. The $33 billion is based on the constant 1978 dollars or 1980?

General **McCarthy**. 1980 dollars.

Senator **Laxalt**. 1980?

General **McCarthy**. Yes, sir.

General **Burke**. The reason the 1978 is up there, that was the SAR, the system acquisition report, which requires you to show it, you know, based on the year it started.

Senator **Laxalt**. But there is no inflation shown on that over the next 6 to 8 years in that $33 billion figure?

THEN-YEAR DOLLARS

General **McCarthy**. Yes, sir, using this figure, if you use then-year dollars, this includes the Reagan administration.

Senator **Mattingly**. What is then-year?

General **McCarthy**. Then year meaning if you put each of these years and put it in inflated dollars and added it up that would be the total cost of the program.

Senator **Schmitt**. Out to what year?

Senator **Garn**. That is what I thought you meant, but then you said within 10 percent.

General **McCarthy**. Yes, sir. Of the projected costs. I was basing my 10 percent on the constant-year dollars figure, and then whatever inflation prediction that you would like to make, inflate it by that figure to then-year dollars.

Senator **Laxalt**. Does then-year mean the same as we use in the budget process, the out-years? Is that what we are talking about, out-years?

General **Burke**. Yes, sir.

Senator **Laxalt**. What inflation factor do you build in there, 10 or what?

General **McCarthy**. The Reagan administration is using eight in the near term and six in the out-years.

Senator **Mattingly**. But that is not in the Defense Department though.

General **McCarthy**. Yes, sir.

Senator **Laxalt**. Apparently they have adopted that.

Senator **Garn**. Well, we can't legally bet in Utah, but boy I would be willing to bet on that, that that $51 billion is going to be awfully low in those then-years. I think it is terribly unrealistic, and I think the Reagan administration is in using 8 and 6 percent, particularly in military procurement, because generally military procurement has been higher than the general cost of living increases.

AIR FORCE INFLATION RATES

Senator **Mattingly**. What is the—you were referring to constant dollars, whatever thay may be, but in the Air Force what has been your inflation figures for the last year, the last 2 years?

I don't mean what you figured in the budget; I mean in reality, what happened from 1 year to the next in the last couple of years?

General **Burke**. It has been running more than 10 percent.

Senator **Mattingly**. Does anybody know where, though, in that percentage, where it was, 15, 20?

General **Burke**. It has probably in the last 2 years averaged about 12 percent. You could find horrible examples of things that use large amounts of titanium, say, where it is 100 percent.

Senator **Mattingly**. But it averaged no more than the regular inflation rate applied to everything else in the country?

General **Burke**. No, it has been higher.

Senator **Laxalt**. What is the year bracket, then-year? What, does it take it out to 1989?

General **McCarthy**. Yes, sir, 1989.

Senator **Laxalt**. From when, fiscal 1981?

General **McCarthy**. Yes, sir, excuse me, fiscal 1980.

Senator **Laxalt**. So you have taken it all the way through.

General **McCarthy**. Yes, sir.

Senator **Laxalt**. And you came up with the inflation factor that Stockman has come with, you come with $51.38 billion, right?

General **McCarthy**. Yes, sir, that's right.

ADDITION OF 1-PERCENT INFLATION FACTOR

Senator **Laxalt**. What does a 1-percent inflation factor add to that?

General **McCarthy**. Sir, it would depend on where it came in the program.

To give you an example, the Carter administration budget using then-year figures of 10 percent, then 8 percent, which is lower, you get the approximately $54 billion figure that the GAO used in their report. That is how they did it. They used inflation.

Senator LAXALT. You could very quickly get in without being terribly pessimistic about inflation, you can quickly get in for this program into $60 billion in a hurry, can't you, General?

General McCARTHY. Yes, sir, I am very careful.

Senator LAXALT. We are all guessing. We know that.

General McCARTHY. The only thing that I would give you confidence in is that in constant-year dollars we feels confident that we can keep that in line, and then it depends on how well the country, Congress, and the President keep inflation in line, which is a concern to all of us.

Senator GARN. Assuming that your figures are right, then, this is baseline. You are not talking about those 6,900 shelters we talked about this morning in response to the threat, and you are not talking about LoADS.

General McCARTHY. That is correct.

COST OF OPERATIONS

Senator SCHMITT. What about operations? Is there any extraordinary cost in operations?

General McCARTHY. No. We estimate the annual cost of operation in constant 1980 dollars is about $400 million. This is a little bit more than the Minuteman system costs to operate right now. It is significantly less than the B-52 and the Trident systems which run at about $1⅕ billion operations support costs. So it is slightly more than Minuteman, significantly less than B-52 and Trident systems.

I will briefly review for you the MCP requirements in then-year dollars using the same inflation factors. These are the programed amounts for 1980 and 1981. This is the figure for 1982, and I will break that one out in subsequent charts.

This is the total cost of the program, the $16.9 billion in then-year dollars compares with the $51 billion figure that we showed as then-year total costs.

SITE DEVELOPMENT

For 1982, the site development would be at the first main operating base which the Air Force proposes for Coyote Spring Valley. These are the approximate breakouts in each of these categories. In addition, we would mobilize four construction——

Senator LAXALT. Before you get off that, General, if I may, these numbers that you have developed, you are talking about Nevada here and Coyote Springs.

General McCARTHY. Under our proposed action.

Senator LAXALT. Does that State agree with those numbers?

General McCARTHY. These would be roads that we would require for our own operation.

Senator LAXALT. It has nothing to do with what we would have to give the State for impact on theirs.

General **McCarthy**. No, sir, those figures are not included on here. We do have an input from the State of Nevada which we are reviewing at this particular time to determine its cost in phasing into that. One of the first things that we anticipate would be required is an expansion of State Route 93 from Interstate 15 up into Coyote Spring Valley, either to old State Route 7 or north into the Alamo area, and where we would actually stop that is a little uncertain at this time. That cost is estimated by the State of Nevada at approximately $40 million. That would turn that 2-lane road into a 4-lane, I wouldn't say, interstate system, but basically interstate-system-comparable road.

Mobilization would involve these support facilities which would begin preparation for construction workers and materials and construction, life support camp and support yard for the first main operating base. The operational base test site is a facility that we would construct several shelters and missile handling facilities so that we could test the design, check out any final design changes before we go into production of both the transporter, the canisterized missile and the shelters themselves. These are long lead-time items that would be required for the first main operating base. We need to order those in advance because of the several year lead-time that we have.

In addition, we have money for two protective shelters to be constructed for testing at Vandenberg Air Force Base.

This real estate acquisition figure is the maximum amount that we envision would be required for that year depending upon which of the four first main operating base sites would be used. The amount in the Coyote Springs Valley is approximately $0.6 million.

At Norton Air Force Base there is a facility immediately outside the gate that we have looked at for acquisition to house the ballistic missile office and the Crops of Engineers' staffs necessary to field the system. That is available for sale at $11 million, and we would propose to buy that facility rather than a long lead-time to construct that facility.

Senator **Schmitt**. Where else do you have facilities that could provide that support?

Senator **Laxalt**. What is a P-3300? Is that your own coding?

General **McCarthy**. That is a budget code for the type of funds that we are talking about under military construction program.

AVAILABILITY OF FACILITIES

In answer to your question, sir, I don't know that there are other facilities available. We felt that in a program of this importance, that we ought to have the staffs of the Corps of Engineers and the ballistic missile office responsible for the design and management of the program as it is being built housed on the same base. Presently we have at Norton Air Force Base the full ballistic missile office staff, and as we get into it, we need to gear that staff up. This other facility is available and appears to be a cost effective way to meet that buildup.

Senator **Schmitt**. What about the general test program, the nonlaunch test program, EMP and vibrations?

General **McCarthy**. Yes, sir, those activities are being scheduled at a variety of different places. For example, some of them will be at the Nevada test site, some will be at the Arnold Test Center that I know your are familiar with, primarily contractors who will do it at their particular facilities.

FACILITIES AT KIRKLAND AFB

Senator **Schmitt**. Will the facilities at Kirkland Air Force Base be utilized?

General **McCarthy**. Some of the facilities at Kirkland will be. AFTAC is there.

Senator **Schmitt**. What about the EMP testing?

General **McCarthy**. I believe that is where it is scheduled to be. Yes, sir, it is.

General **Burke**. I believe the bulk of it is done at Kirkland. We are actually doing an underground test to get the hard data on it, but we use the dipole and the trestle there.

General **McCarthy**. So the subtotal for construction in fiscal year 1982 is $366 million. The planning and design here would permit us to complete design of the 1982 facilities, to design for 1983, and the initial design for 1984 construction.

COSTS PER SHELTER

Senator **Schmitt**. Do you have a cost per shelter figure, average, say for the 4,600 shelters, and then a cost of continuing that process per shelter?

General **McCarthy**. Yes, sir, I do, and it depends on whether you are talking about the actual facility itself, or you are adding the communications, environmental controls, security and all the other things that are necessary in a completed system.

It is about $3 million, and that is fully completed and including a portion of the cost of the missile, and the actual shelter itself standing there is about $1 million.

Senator **Schmitt**. So your MilCon budget includes just the shelter. It doesn't include the air conditioning and the other stuff.

General **McCarthy**. The environmental control, that is all in there.

Senator **Schmitt**. That is in the $3 million figure?

General **McCarthy**. There are some——

Senator **Schmitt**. Then I don't understand, when I divide 4,600 into $9 billion I get $2 million per shelter approximately.

AIM POINT COSTS

General **McCarthy**. That is why I asked the question, sir. There are some things called aim point costs. What would it take to add additional shelters, fully operational, to the system, and that includes military construction, environmental control, things of this nature. There are other pieces of equipment that are neither mobile or not normally considered part of the military construction program but are part of the production that are not included in those costs, and I can give you a detailed breakout of those, if you would like.

If you are talking about shelter costs completed, but for expanded threat levels, about $3 million a shelter. If you want to multiply that by adding a thousand shelters, then you are in the right ballpark.

Senator SCHMITT. Maybe we ought to have some expansion of that for the record because again, when I look at the MilCon line item on one of the charts, that figure doesn't jibe.

For 4,600 shelters, your 1978 dollar cost was $9 billion for MilCon, right, $9——

General MCCARTHY. Yes, sir, $9 billion.

Senator SCHMITT. Excuse me, that is $2 million per shelter.

General MCCARTHY. Yes, sir.

General BURKE. Are there not things that go in the shelter that are not MilCon?

Senator SCHMITT. That is all I am asking.

General WRIGHT. There are some items in the shelter that are not MilCon that are direct support related, and that gets into——

Senator SCHMITT. That would be part of the $400 million per year cost?

General BURKE. It would be on the procurement account. It would be installed equipment that you have been buying as procurement items and installing it in.

Senator SCHMITT. All right.

BREAKDOWN IN SHELTER COSTS

General MCCARTHY. To give you an example, the shelter itself is $0.986 million itself in 1980 dollars, or in 1978 dollars, $0.68 million. The canister and launchers, of which there's a small number, the launchers, about $3 million in 1979, the canisters, about $1 million in 1978 dollars. One of the costs of extending the shelter is the roads necessary to get access to it, and we have those costs broken out as well. We can provide that for you.

Senator SCHMITT. I think it might be helpful to have a more detailed breakdown.

BASE-YEAR DOLLARS

Senator MATTINGLY. Let me ask you before you go, you are talking about $3 million in 1978 dollars.

Is that what we are trying to figure out in the 1981 budget? Is it still $3 million?

General BURKE. No, sir.

I know this sounds convoluted. The requirement is we will always report the cost of the MX in what are called base-year dollars, that is, the year that the program started. We will show that and we will also show it in then-year, and we will also show each year's appropriation in that year. So there's three different ways you can look at it, and it does get confusing. I personally have never been able to understand then-year dollars.

Senator MATTINGLY. It is trouble enough appropriating in this-year dollars. That is my problem.

General BURKE. The ones that count.

SCHEDULE FOR MX-MPS

General McCarthy. This is the schedule for MX-MPS. We entered full-scale engineering development in September 1979. We anticipate the construction of the roads, utilities and facilities support I described in early 1982. Facility construction other than getting ready for construction, as we call it, beginning in 1983, with our first flight test scheduled out of Vandenberg in 1983. We start shelter construction in 1984. That enables us to have our initial operational capability in 1986 and full scale, or excuse me, fully operationally capable in 1989.

BUY DELIVERY SCHEDULE

This is the buy delivery schedule for missiles and shelters. The buy schedule is when we basically obligate. The delivery schedule is when the Air Force received those particular shelters for checkout.

The same way with the missiles available then for deployment. You will notice that the number of missiles is higher than the 200 proposed. The remainder of those are part of the initial test flights, and then the continued operational testing that goes on through the life of the system.

Senator Laxalt. On this point, we have been told around here, and I guess the information is reliable, that we have 300 holes in Minuteman which will take the MX.

Is that true?

General Burke. I think it is 400, the so-called deep, the last 400.

Senator Laxalt. All right.

General Burke. With minor modifications.

Senator Laxalt. I understand.

I was just trying to determine here the delivery time on the missile. I see, OK.

General McCarthy. These are the delivery schedules here which varies differently than the deployment schedule.

If you remember I showed in 1983 the first costing for nine missiles, and here is the delivery in 1985.

Senator Laxalt. Thank you.

Now we are getting down to the nitty-gritty.

BASING AREA SELECTION

General McCarthy. Basing area selection.

I will remind you that the Air Force went through a narrowing process that involved the entire continental United States and then using geotechnical and other criteria narrowed it to the Southwestern United States, and then using operational criteria, narrowed to the four States shown here. That process is described in the environmental impact statement, Environmental Technical Report No. 1, in some significant detail, so I will not go into it here.

To support these various combinations of systems we identified seven operating base locations to support those systems. Basically the alternatives that the Air Force has under consideration was the entire system in Nevada-Utah, the entire system in Texas-New Mexico, a split basing. If you recall, we provided Congress a report on split basing which basically concluded that there were no operational advantages or disadvantages to split basing. The cost of the system increased primarily due to redundancy of facilities by about $3½ billion.

Senator GARN. Let me ask you a question at that point.

Part of the reason for that additional cost is that the Air Force has never been willing to consider what I think are some arbitrary decisions like the 200-mile limitation.

Can you defend at this point additional vulnerability if you are closer than 200 miles to an ocean or to an international boundary? Sea-launched cruise missiles will be able to strike Utah and Nevada from the west coast. It makes no difference whether they are closer to the coast or not. There is public land, as you well know, less valuable land in Texas where Senator Tower would be willing to accept part of MX, but not in the area selected.

General McCARTHY. Sir, the threats have been considered, and I acknowledge that the 200-mile limit was a judgmental call based on the potential threats that we have. We are looking at that, reviewing that to see if there are any things that we missed in that analysis because of that portion of Texas that you referred to.

It is our judgment that it is not just whether the systems can reach there but the amount of warning time that you gain by those kinds of systems, and specifically in coming up with that 200-mile general parameter, we did consider sea-launched cruise missiles or cruise missiles launched from air but out over the water in that threat, and one of the things we gain is that we extend the range of the cruise missile—you have to move in closer to fire those in order to hit the target with the present capability, although acknowledging that they could extend it in the future. But what it gives us is warning time of that kind of attack.

Senator GARN. But from the Mexican border how much difference are you talking about between 70, 80, or 100 miles? You are not talking about much time difference there of any significance? If you are saying 1,000 miles, that is something else, but 100.

General McCARTHY. Yes, sir, and in those cases we are concerned about such threats as jammers that could be deployed along the southern border, admittedly, in a different political climate than exists now, but that have the capability to reach that far inland and offer some potential problems to command and control system for MX-MPS.

Senator GARN. It sounds to me like you need more than 200 miles, then. Two hundred miles is no big jamming problem.

General McCARTHY. Sir, that was one of the factors, and I can't remember the exact amount that we allowed for that, but I think it was closer to 100 miles for that particular threat, wasn't it?

JAMMING PROBLEM

Major BRAS. Jamming is a tremendous problem, sir, because of the environment you would be in and the type of jammer employed, probably a low frequency jammer using line of sight. We are not worried about the long range HF jammers or UHF jammers as much. The standoff ones in Cuba, for example, or possibly Cuba, the specific systems were analyzed in rather rigorous detail.

Senator **Garn**. Well, I will conclude by saying I still don't agree there is anything magic about 200 miles.

General **McCarthy**. Sir, we are not trying to defend precisely the 200 miles. We looked at a variety of operational reasons why you would want some distance between shorelines, borders to the MX deployment system, and the judgment was that approximately 200 miles seemed like a prudent thing to do in basing the system.

The white areas here reflect geotechnically suitable areas in Nevada and Utah for deployment. Not all of those valleys would be required for the 4600 system.

PROPOSED OPERATING BASES

The Coyote Springs is the Air Force's proposed main operating base for the first base. What aids in that is the large metropolitan area of Clark County, Las Vegas here, the infrastructure, the labor force, and the growth that would occur there in the initial years appears to be best handled by this.

An alternative main operating base is in one of these three locations, approximate to Ely, Nev. If we build our first main operating base at Coyote Spring, we plan to build our second main operating base at Milford; other locations in Utah are Delta and Beryl. If the system is deployed in Utah, the preferred action on the part of the State and local officials appears to be the Milford location. We came to a similar conclusion, probably for the same reasons, but there are five smaller communities in that area where construction of the proper transportation networks would aid in spreading the impacts among five communities rather than imposing them on a single community as you would do up here at Delta. There is no very large community here in Beryl.

TEXAS-NEW MEXICO ALTERNATIVE

This is the alternative deploying the full system in Texas-New Mexico. Under that case, our first main operating base would be an extension of Cannon Air Force Base at Clovis, N. Mex., and a second main operating base would be at Dalhart, Tex.

The split basing alternative places half the system in Nevada-Utah with the first main operating base at Coyote Spring, the second main operating base at Clovis, with the majority of the shelters for this half of the system in the area immediately around Clovis.

Senator **Laxalt**. Well, if you can go back, what is the area that John Tower talks about abutting the Mexican border would be freely available?

General **McCarthy**. I believe that is down in here.

Senator **Laxalt**. Is that it?

General **McCarthy**. I believe that is the area he has described.

Senator **Laxalt**. OK.

Senator **Garn**. All you have there is the border. You don't have the sea-based threat.

Senator **Laxalt**. Is the border again the principal problem? Is it generally the proximity, the problem of jamming?

General **McCarthy**. There are a number of threats that could be employed, recognizing that that nation has political status right now that is supportive of the United States. What we are trying to do is project a system for the next half century and hopefully would anticipate those kind of threats that could be deployed. A listing of threats, in addition to jamming, would be efforts, long range, to try and determine the location of the missiles through layouts and some antenna systems and things of this nature which, while that distance would require them to use very large antennas, they would be in an area that we would have no control over, and could not determine what their purpose would be.

Senator GARN. Have you considered the threat of Basque sheepherders in Nevada in all of your calculations?

General MCCARTHY. Sir, I have met with some Basque sheepherders and I found them to be most patriotic.

Senator GARN. I'm sorry, I just couldn't resist. Senator Laxalt and I have this ongoing battle, and it brightens up the day.

General MCCARTHY. This is the review group that the Secretary of Defense has appointed to review this decision. They are presently ongoing. The anticipated report is sometime near the end of June, and then we anticipate a presidential decision sometime in July.

Senator LAXALT. Is there a draft running around?

General MCCARTHY. I don't believe there is.

Senator LAXALT. They have the last meeting when, this week?

Senator GARN. That was last Saturday.

General BURKE. That turns out not to be the last one. They are going to have another last meeting.

Senator LAXALT. Another one?

General MCCARTHY. Sir, that completes our review of the MX system status.

There are many things, as you know, that I have not addressed, but we will be happy to respond to your questions.

Senator GARN. I would like to ask General Burke one.

FIRST-STRIKE CAPABILITY OF MX MISSILE

In your testimony earlier today you talked a great deal about all of your charts and the drawdowns and all of that. One point that I really failed to see the point of is the possible first-strike capability of the MX. That has nothing to do with the basing mode. That is the missile. It doesn't matter where you put it. If the Soviets think it has a first-strike capability, it does, no matter where you base it. So I just wanted to make sure I understood that it all seemed kind of to come together, but it really has nothing to do with MPS.

General BURKE. No. The purpose of the MPS is to give us confidence in the viability of our force. One of the consequences of the MX missile being deployed anywhere is that you will force the Soviets to think long and hard about how much they want to keep in silos.

Senator GARN. Well, I understand, but the point is if we had national policy or decided that we would strike first, it doesn't matter how you base it. You could have a first-strike capability. That is a policy decision, not a function of the basing mode.

LAUNCH ON WARNING/LAUNCH UNDER ATTACK

Senator **Laxalt**. Help me on the terminology. What is the difference between, if there is any, between launch on warning and launch under attack?

General **Burke**. People use them interchangeably, but a distinction can be made of launching after the first impact.

Senator **Laxalt**. After the first impact?

General **Burke**. Yes.

Senator **Laxalt**. So if you are talking about first strike, say on Minuteman with the present capability, you are not talking about any counterforce thing unless you are talking about the remaining 200 that we talked about.

General **Burke**. As a general rule, people use those terms interchangeable and don't make that distinction, but there is a circumstance one can imagine, say, I will not launch based on sensor data that I have incoming RV's, but when a nuclear explosion takes place and I have confirmation of that, then I will launch whatever is left.

Senator **Laxalt**. Is that our policy now, we have to wait until something is hit?

General **Burke**. No, sir, our policy is not to have a policy.

Senator **Laxalt**. To stay as loose as possible.

General **Burke**. That's right.

Senator **Garn**. How much deterrent capability do you think it would give us if we simply had a President who announced to the Soviets, look, if you attack us, you are going to hit empty silos. That is the national policy.

What does that do for the whole equation?

General **Burke**. I think it creates in a crisis situation a rather dangerous circumstance. If we announce that, I think the Soviet would have a similar policy, if indeed they don't already.

Senator **Garn**. There is no doubt in my mind that they do.

General **Burke**. I think we would then in time of crisis both put our finger on the trigger, and I think we would be sitting there looking, and probably nothing would come of that, but that would be a terrible time to have something inadvertent, some miscalculation, some mistake, some confusion.

Senator **Garn**. Well, let me ask you this. We talked a great deal about a mistake in the situation, and I realize there are some holes in the system and some holes in the command and control structure for making a decision, but we are not talking about a flight of geese or a few missiles showing up. If the Soviets are going to launch the first strike, it is not going to be 10 or 12 or 15 or 100 or 200 missiles, it is going to be thousands. Now, with all of these errors we hear about that say there is a nuclear attack underway and computer problems and so on, can you really mistake a first strike of the magnitude that would be necessary to knock out Minuteman III? It has got to be massive or they are fools if they launch a partial attack, and how are you going to really mistake thousands of ICBM's for a flight of geese?

General **Burke**. I don't hold to the flight of geese proposition to begin with. The flight of geese——

Senator **Garn**. Well, I don't either, but it is just to illustrate my point.

General **Burke**. Well, it is a historic incident, and the geese have some impact on radars. The BMEWS conceivably can see geese as ICBM's, but that is one of the reasons why we have what is called multiple phenomenology. We have infrared sensors, we have radar sensors, and to an infrared sensor a goose doesn't look like anything but a goose. [General laughter.]

So I don't think that is—the problem is——

SATELLITE DETECTION OF LAUNCHES

Senator **Garn**. What about satellite detection of launches? Again, you have got a tremendously abnormal activity, with a lot of those things popping out of the silos.

General **Burke**. What you don't know is where they are going and that would tend to——

Senator **Garn**. I don't think they are going to Iran or Afghanistan.

General **Burke**. You can ascertain very quickly that they are coming to the United States but you wouldn't be sure whether it is a counterforce only attack or whether they are going after cities.

Senator **Garn**. What difference does it make?

General **Burke**. I think it would make a big difference in where you sent your missiles if you wanted to launch on warning. I think what you wouldn't want to do is respond to a counterforce only attack, mistake that as an attack against the cities by going after Moscow and Leningrad. You wouldn't want to do that.

But I have a lot of trouble. I find all nuclear exchange scenarios just inherently implausible.

Senator **Laxalt**. Inherently implausible?

General **Burke**. Yes; none of them sound real to me.

Senator **Laxalt**. Because the premise is unreal that it would happen at all? I guess that is what makes it all unreal.

General **Burke**. So I bog down talking about shooting this or shooting that.

Yet I have two cautions on that. One is as I mentioned this morning, the history of warfare has a lot of implausibility in it. There have been some bizarre things. But I really worry about the political consequences of the civilianry more than I do the military consequences, and to the extent that the Russians believe themselves ahead and see themselves ahead, they are going to pursue those adventures at the margin that they would otherwise consider too risky.

Senator **Laxalt**. Unless they had a President whom they knew they wouldn't fool with. It makes a bit of difference.

General **Burke**. And the role of the President is certainly vital.

Senator **Laxalt**. You know, when you talk about the bucks that we are talking about, all of the other problems that we have lived with for so darned long, and you look at the Soviet psychology, at least I sensed over there the last thing those people over there want is another war after the harm that came to them, and the strength of our Triad, the great improbability of their even launching a first strike, and the fact that we could use the MX and the existing Minuteman holes and increase our capability there immensely in ever way, then you begin to wonder about whether all of this makes sense. You are talking about pumping a $100 billion package, an enormous disruption, you get to the bottom line and wonder whether it is all worth it or not in terms of buying an insurance policy. You know, I am not going to go out and buy an insurance policy because it is a 10,000 to 1 shot in terms of the odds. I don't know what the odds are here. I just don't know.

On the other hand, you say to yourself, well, that is a risk that this country cannot assume, regardless of the improbability. It is a tough one to call, isn't it?

General **Burke**. It is a very tough call.

Senator **Laxalt**. I don't know.

What about this theory that has been propounded, I guess as much by a couple of western Senators as anybody, about taking MX and Minuteman and support it with ABM?

General **Burke**. Philosophically I think that is fine.

Senator **Laxalt**. Philosophically it doesn't project any technical objection or philosophical objection?

General **Burke**. I think technically and practically there are some problems.

Senator **Laxalt**. You think there are problems?

I mean, let's brush the treaty aside. I mean, what we talked about today, the treaty is gone for all intents and purposes. If it isn't gone, it sure is going to be next year.

General **Burke**. In principle, that would meet all the objectives I have, and that is to provide for the survivable land-based ICBM force. The practical concerns I have are two: setting aside the consequences of the ABM Treaty—and I think there are a couple of real things that ought to be thought about there, too, before we finally decide.

Senator **Laxalt**. Well, I understand that.

General **Burke**. One is I think if we signed it, I think in 1972 when we signed that treaty, the United States was well ahead of the Soviet Union in regard to its position to move out with the ABM's. I don't think that is true today, and I have seen estimates that would indicate that probably for the first 5, maybe 10 years the Russians would be in a better position to take advantage of an abrogation of the ABM Treaty than the United States.

IMPROVEMENT IN U.S. TECHNOLOGY

Senator **Laxalt**. That is a critical point. We have been led to believe to the contrary, that our technology has improved tremendously, particularly in terms of LoADS, that we would be well in front of them.

Is that a mistaken notion that we have?

General **Burke**. The earliest IOC that I have seen for LoADS is on the order of [deleted]. Maybe if you really pushed it you could get it started in [deleted] and I have seen estimates that the Soviets could have 5,000 operational launchers by [deleted]. So that is a little niggling worry in the back of my own mind.

The other worries I have about it are that I am not sure that we can build a silo-based ABM system of the kind we would want in the time we want. I think we could build a relatively expensive system fairly quickly, like LoADS, but LoADS gets to be very expensive when you have got to defend all of the thousand shelters rather than just the 200 that are loaded in MPS. And certainly with that kind of system the Soviets can counter it at a fraction of the cost to us.

So that is the wrong side of the arms race to be on, I think where our action costs $5 and their response costs $1. I think if we get ourselves in that position, we are going to see one hell of an arms race. I think we ought to strive to get on the other side of that equation, and I think the kinds of ABM systems that people talk about in the late 1980's or early 1990's are that mode. Later on people imagine sort of MIRVed ABMs where one ABM goes up and shoots down 10 or 20 incoming RV's. If you can get to that point, then you may well come out on the right side of the cost equation.

SOFAS SYSTEM

Senator **Laxalt**. How do you feel about the SOFAS system that the Army has been briefing us on?

General **Burke**. Have you seen that briefing, General? I haven't seen it.

General **McCarthy**. Not in enough detail to comment about it.

Senator **Garn**. I am a little bit puzzled. The same problem would occur there. Today you are advocating, saying the ABM is fine if we put it with MPS, 6,900 shelters. Well, you have got additional costs for the ABM for that and for the 1,300 of the 2,300 additional shelters as well. So I am not convinced that ABM protecting critical silos is more expensive than adding to the MX-MPS system, is it?

General **Burke**. Let's just say that a successful ABM, say, costs $5 and that the Soviets can build warheads for $1. If we have to, if we deploy that interceptor at each of our 1,000 Minuteman field, and the Soviets attack with 1,000 RV's and each of our interceptors goes up and does its job and works, then the Soviet counter to that is to add another 1,000 RV's, and we are right back where we started.

Senator **Laxalt**. Why would we have to protect, General, all 1,000 holes? Why couldn't we just protect the 300 or the 200 or whatever we come in with with MX?

General **Burke**. You are going to have to protect them more than once because they are just going to keep coming after.

Senator **Laxalt**. Unless you have launch on warning.

General **Burke**. If you have launch on warning, then you don't need the rest.

USE OF DUMMY HOLES FOR MINUTEMAN

Senator **Laxalt**. Well, that is the other point that Sam mentioned here. What is the feasibility of going to dummy holes with Minutemen, going back to the original vertical system we proposed for Nevada and Utah, and that is some of your people are telling me we have got private land to deal with, but I am told that some of those areas might be receptive to getting this additional land for dummy holes out of there.

Does that make any sense at all?

General **Burke**. Yes, sir. Again, philosophically it is fine. It is the practical questions. We would, I expect that is a fair bit more expensive.

Senator **Laxalt**. It will be in terms of land acquisition.

General **Burke**. It would be in construction costs higher in that part of the world. We would have to start the environmental process all over again, and we are 2 years into it, and our experience has been that people often think this is a good idea until they give it a little thought. You might recall that at one time the Governors of both Utah and Nevada wrote the President and said they thought it was a pretty good idea and would like to have it.

Senator **Laxalt**. I think you are probably right. I think a lot of those people who appeared to be receptive, once it actually hits, there is a probability you get the same kind of hate we are getting in Nevada and Utah as to where they go.

Senator **Garn**. On the other hand, the more I look at MPS, forgetting where it is—and I know that is probably hard to accept from either one of us—but we hardly have a record of being anything but prodefense, even when it wasn't popular to be prodefense, but wherever you put it I see some major problems I think you are taking some major risks in MPS that you don't have the answers to. You can stand up there and tell us all day, there more I have looked at it, I think there's going to be some surprises here, and I would be willing to make bets on 1986 for those first nine missile, too. My hindsight just tells me that.

Senator **Laxalt**. What are you talking about, cost, delay in delivery?

Senator **Garn**. Cost, delay, delivery, the whole thing, from C-5A's. I guess I have been on the inside too long, and once or twice I have seen something cost less or be finished before it was supposed to be.

General **Burke**. It is the exception.

Senator **Garn**. It is 24 years of wearing that suit that tells me that, not sitting here. It is the exception. I don't question your sincerity. That isn't my point. But beyond your control, and who is going to be there? I don't know whether you will be, whether you will have your fourth star, gone, retired, and somebody else is there and you are fishing in Florida or wherever. Sorry, we slipped 2 or 3 years like everthing else.

So I can't fight you on what you say individually, but I can look at the general situation. I am just as willing to take a chance on some of the uncertainties in an ABM as I am on what you tell me, and that is no discredit of your sincerity at all, what you are telling us. DIA's testimony, [deleted] warheads, sounds to me like you have no choice, that the original baseline is not adequate for very long. It is vulnerable, so then you have got a choice of a lot of additional shelters or an ABM system.

SOVIET INCREASE OF SILOS

General **Burke**. I personally don't believe, if we deploy the MX, the Soviets are going to increase their silo count to [deleted].

Senator **Garn**. Warheads, not silos.

General **Burke**. Warheads in the silos.

Senator **Garn**. Why not, Kelly? If we do something like that, why can't they like everybody else say we are destabilizing, and look at their answer to a unilateral disarmament with 1054 ICBM's and the B-1. They went right ahead. I think they are going to build [deleted] warheads, or [deleted] or [deleted] regardless of what we do.

I have seen no evidence in 30 years that indicated to me that they care what we did except to use us to sign treaties to stop us from doing something that we were ahead in, and most of the arms control agreements with the Soviet Union have always limited in area that we had an advantage while they caught up. And then they sit there and say, good Lord, are these people really that dumb that over and over again the first 25 times, but then we continue to have hope and optimism that they are not going to do something while they prevent it.

General **Burke**. Well, my line of thought is not inconsistent with that thesis at all. I agree with it.

I think they will not add to their silo force for reasons of pure self-interest and self-protection. I think they are going to be intimidated by those MX's when they get out there. I think they are going to see their existing silo force at risk.

Senator **Garn**. Well, if you are not talking about silos, then let's talk about mobile something. Maybe you are right, maybe they won't stuff more in silos, but they are going to stuff more someplace, hide them in woods. I think they have got at least 1,000 hiding in the woods now, 1,000 missiles, some of them outdated, obviously, old and not accurate, but they have still got live warheads on them.

General **Burke**. Well, there certainly has been no accounting of what happened to the old ones.

Senator **Garn**. No, none. We have no evidence that they have destroyed them. They have destroyed launchers. We have no evidence that they have destroyed one single missile other than obviously some because of old age and whatever becoming inoperable.

Senator **Laxalt**. You are going to have to excuse the Chairman. He is going to have to go. If you will kindly take over for whatever remaining time there is, we will be coming back in, as you know, for a couple of more sessions. I hope that you might be available in case we need you. There may not be any need, but there may be.

General **Burke**. I will be in town.

Senator **Laxalt**. Some of these other panels, like OTA, might be interesting for us to sit you down at one table while everybody is here in one place with whatever evidence they could bring on, just have a panel discussion so it will be a little freewheeling.

Senator **Burke**. We will be delighted to.

Senator **Laxalt**. So we feel our responsibilities rather heavily, and time is running out.

General **Burke**. I don't envy you.

Senator **Garn** [presiding]. I have just a couple more questions.

Senator **Laxalt**. If you will excuse me.

Senator **Garn**. As soon as you leave I will try to get it all in Nevada. [General laughter.]

TIME ESTIMATES FOR RETROFIT OF SILOS

Senator **Garn**. On the matter of putting MX in existing Minuteman silos, do you have any estimates of time for retrofit of 200 silos, putting in MX, apart from ABM?

General **Burke**. We can do that as quickly as the MX missiles will be available. We can have the silos ready to accept the missiles when they come off the production line.

Senator **Garn**. So there is no time delay.

General **Burke**. It is not that big a task.

ENVIRONMENTAL LEGAL SUITS

Senator **Garn**. Do you have any opinion of these environmental suits that have recently been filed, just in the last week or so?

General **Burke**. The first suit that was filed was adjudicated in our favor, and that had to do with the soil compaction test that we are doing in Ralston Valley, Nev., and the Federal judge in Las Vegas ruled against the plaintiff and said that he was not about to stop a defense project on the basis of a vaguely perceived problem as was asserted. I have not seen the details of the current one, but I think our lawyers are generally optimistic.

EFFECT OF MX DECISIONS ON NEW BOMBER

Senator **Garn**. What effect will the decision have on the new bomber, have on the overall threat, whether it is a modified B-1 or——

General **Burke**. I think the decision not to build the MX or cut back on the MX or delay the MX puts pressure to move forward with the bomber and vice versa.

Senator **Garn**. But beyond that, what if you increase the load rates on the strategic bomber force by 10 percent? Is that good for you?

What I am talking about is as far as a deterrent, not a replacement for MX. I am talking about as an additional deterrent to Soviet strike.

General **Burke**. I think every additional increment that you have on alert has its deterrent value. It has a pretty high trade to be made with the number that you keep on alert and enhance your day-to-day position with the overall capabilities of the units when their full capability is generally—it tends to be pretty heavy. Speaking as an exwing commander, you tend to pay a pretty heavy price for those additional ones. That means you have got more crews, then you have got to fly more, you have got to have more maintenance people, more spare parts, and you generally get shorted on all that. So although you are in a better shape day-to-day alert, the overall force seems to be less well maintained and less well trained than at the lower rates.

VULNERABILITY OF BASELINE

Senator **Garn**. From what I have heard today both from you and from DIA, isn't it really pretty certain that by 1990, about the time you get the MX system deployed, that the baseline is really vulnerable?

General **Burke**. I don't believe so.

Senator **Garn**. You are going to have to get it to at least that second scenario of the 6,900?

General **Burke**. I personally don't believe so, but that is just a matter of judgment, and the answer is not only unknown but unknowable.

Senator **Garn**. Don't you disagree with DIA's testimony then?

General **Burke**. No. DIA testified as to what Soviet capability was. There is no doubt that they can do that if they elect to do that, but I don't think any of us have any insight into what their intentions are. I doubt that they have addressed it. I think that they will wait and see what we do.

Senator **Garn**. Well, I agree it is hard to address their intentions except on hindsight, but again it was answered earlier today that they had exceeded many of our estimates in the past, so why would it be different now?

General **Burke**. I always assume that they will invest their military dollars where they calculate it will give them the most advantage over us.

Senator **Garn**. That has always exceeded what they expected we would do. In every area, whether it is submarines or ICBM's, cruisers, frigates, whatever.

General **Burke**. Until we had the famous Team A-Team B review, I think the intelligence estimates were systematically lower than they should have been year after year. I think they have not been too far off the past few years, and I think that Team A review was very salutary to the estimating process.

Senator **Garn**. I have no more questions today. Thank you very much for your patience and time.

SUBCOMMITTEES RECESS

The subcommittees will stand in recess until Thursday, June 18, at 10 a.m. when we will meet in executive session to receive testimony from the Office of Technological Assessment on their basing mode study.

The subcommittees are adjourned.

[Whereupon, at 4:36 p.m. Tuesday, June 16, the subcommittees were recessed to reconvene at 10 a.m., June 18.]

MX MISSILE BASING MODE ALTERNATIVES

THURSDAY, JUNE 18, 1981

U.S. SENATE,
SUBCOMMITTEES ON MILITARY CONSTRUCTION
AND DEPARTMENT OF DEFENSE,
Washington, D.C.

The subcommittees met at 10 a.m. in room 1223, Everett McKinley Dirksen Senate Office Building, Hon. Paul Laxalt (chairman, Subcommittee on Military Construction) presiding.

Present: Senators Laxalt, Stevens, Garn, Andrews, and Mattingly.

OFFICE OF TECHNOLOGY ASSESSMENT

STATEMENT OF JOHN H. GIBBONS, DIRECTOR, OFFICE OF TECHNOLOGY ASSESSMENT

ACCOMPANIED BY:

- LIONEL S. JOHNS, ASSISTANT DIRECTOR, OFFICE OF TECHNOLOGY ASSESSMENT, ENERGY, MATERIALS, AND INTERNATIONAL SECURITY DIVISION
- PETER SHARFMAN, PROGRAM MANAGER FOR INTERNATIONAL SECURITY AND COMMERCE, OFFICE OF TECHNOLOGY ASSESSMENT
- ASHTON CARTER, MX PROJECT STAFF, OFFICE OF TECHNOLOGY ASSESSMENT
- FORREST FRANK, MX PROJECT STAFF, OFFICE OF TECHNOLOGY ASSESSMENT
- MARC MESSING, MX PROJECT STAFF, OFFICE OF TECHNOLOGY ASSESSMENT
- THEODORE POSTOL, MX PROJECT STAFF, OFFICE OF TECHNOLOGY ASSESSMENT
- ROBIN STAFFIN, MX PROJECT STAFF, OFFICE OF TECHNOLOGY ASSESSMENT

REVIEW OF MX MISSILE BASING MODE FINDINGS

Senator LAXALT. The subcommittees will come to order.

This morning we are continuing our hearings on the basing modes for the MX missile.

Our witnesses this morning from the Office of Technology Assessment are Dr. John Gibbons, Director, and Dr. Peter Sharfman, Program Manager for International Security and Commerce.

The Office of Technology Assessment has made an in-depth review of the MX missile and its basing mode options. Our witnesses will present their findings at this hearing.

I would like to once again remind all present that we are still in executive session for these hearings and the information received is not for public release.

I want to welcome our witnesses. Mr. Gibbons, will you please proceed?

Mr. GIBBONS. Thank you, Mr. Chairman.

As you know, the Office of Technology Assessment, OTA, specializes in studies concerning technical issues which require a substantial amount of analysis. Ted Stevens, our chairman, has described us as a shared resource for the committees of Congress, where we undertake projects that require either a depth of analysis or breadth of coverage and commitment of resources that no single committee staff can provide in addition to its other duties.

We are governed by a 12-member board that is bicameral and bipartisan, chaired by Senator Stevens.

My presence this morning with Dr. Sharfman is to report to you on a major assessment which is in the final stage of completion of OTA. The question is, of course, how can the MX missile be based?

Dr. Sharfman is on my right. He is our Program Manager for International Security and Commerce and is director of that assessment project.

INTRODUCTION OF ASSOCIATES

Sitting directly behind us—and they may stand as I give their names—are Skip Johns, who is my Assistant Director for Energy, Materials, and International Security, and this project is one of his responsibilities; and technical members of the MX project staff which can supply backup information this morning as required include Ash Carter, Forrest Frank, Marc Messing, Ted Postol, and Robin Staffin.

By the time we get near the end of the testimony we may want to put some figures on the board for you, but I will describe these as we go along.

RELEASE OF OTA STUDY

The study was requested, Mr. Chairman, by our Board in May of 1980. The Board, a half hour ago, authorized the release of our report, but I must make it clear that as a matter of practice neither the Board as a whole nor any individual member of that Board endorses OTA findings and studies. It is our normal procedure to convene a very distinguished advisory panel to help us with each study that we undertake. The panel in this case was, as usual, an expert one. It was chosen to represent the full range of views on the subject.

That panel offered valuable advice about our study plan as we began the work and constructive criticism of the work throughout its progress; however, we do not ask our advisory panels to endorse or approve our report but, rather, help us in our effort to give a fair representation of all of the major points of view and relevant data.

When this report is printed, it will appear as an unclassified report, with a classified annex.

OTA REPORT SUMMARY

With your permission, I would like to submit the summary of our report, the unclassified summary, for the record when it is completed, either tomorrow or Monday.

Senator **Laxalt**. It is so ordered.

[The report follows:]

MX Missile Basing

INTRODUCTION

The U.S. Air Force is developing a new intercontinental ballistic missile (ICBM) known as the MX. Because the hardened "silos" in which existing ICBMs are based are considered increasingly vulnerable to a Soviet attack as a result of the improving accuracy of Soviet missiles, Congress and the Department of Defense (DOD) have agreed that a more survivable mode than hardened silos should be found for basing any new missile. OTA has examined a variety of ways in which such a missile could be based.

The purpose of this study is to identify MX basing modes and to assess the major advantages, disadvantages, risks, and uncertainties of each. At the outset of this study, OTA reviewed all the basing modes that could be identified, including those addressed in past DOD studies. On the basis of criteria of technical feasibility and the likely ability of each basing mode to provide survivability against a range of plausible Soviet threats, the list was narrowed to 11 basing modes which were analyzed in detail. This report presents these analyses, and also states briefly why other possibilities were rejected. Detailed analyses narrowed the range to five possibilities:

1. multiple protective shelter (MPS) basing in several variants,
2. antiballistic missile (ABM) defense of MPS basing,
3. launch under attack,
4. basing on small submarines, and
5. basing on large aircraft.

There is a variety of criteria against which these basing modes can be evaluated, though there is no general agreement about their relative importance. Indeed, since no basing mode ranks highest against all the commonly used criteria, deciding how to choose and weigh the criteria of evaluation is the essence of choosing a basing mode. To help Members of Congress assign the most weight to those criteria they consider most important, OTA has compared these five basing modes separately against these criteria in the last section of this summary chapter.

OTA was requested by the Technology Assessment Board to examine only basing modes for the MX missile. For this reason, the analysis does not address the questions of whether and why the missile itself is needed, or the relative merits of deploying additional numbers of existing Minuteman III or Trident I missiles. During the course of the study the Board requested that an analysis of rebasing the existing Minuteman III missiles in MPS to increase their survivability be included. Since the large size of the MX missile limits the ways in which it could be based, OTA surveyed basing modes that might be used for smaller missiles, but found none so attractive as to lead us to seek a change in our terms of reference. We note that much of OTA's analysis is premised on the accuracy of U.S. intelligence about the capabilities and growth of Soviet strategic forces. Due to the study boundaries, OTA's criteria of analysis and comparison tend to use, rather than critically evaluate, conventional wisdom about how strategic nuclear forces support U.S. national security.

OTA does not have a recommendation as to which basing mode, or combination of basing modes, Congress should choose. OTA is therefore able to present the relevant technical information regarding each possibility without the need to make and defend a choice. This study provides data, analyses, and explanations that will assist Congress to understand and evaluate the forthcoming Reagan administration proposal, whether this proposal turns out to be a reaffirmation of the existing program as shaped by the Carter administration, a relatively minor modification, or a major change in direction.

PRINCIPAL FINDINGS

1. There are five basing modes that appear feasible and offer reasonable prospects of providing survivability and meeting established performance criteria for ICBMs. They are: 1) MPS basing of the type now under development by the Air Force or in one of several variants. MPS basing involves hiding the missiles among a much larger number of shelters, so that the Soviets would have to target all the shelters in order to attack all the missiles. If there are more shelters than the Soviets could effectively target, then some of the missiles would survive. This approach was the choice of the Carter administration, and one variant of MPS is now under engineering development by the Air Force. 2) MPS basing defended by a low-altitude ABM system known as LoADS (Low Altitude Defense System); 3) reliance on launch under attack so that the missiles would be used before the Soviets could destroy them; 4) basing MX on small submarines; and 5) air-mobile basing in which missiles would be dropped from wide-bodied aircraft and launched while falling. As described below, each of these alternatives has serious risks and drawbacks, and it is believed that choosing which risks and drawbacks are most tolerable is a judgment which cannot be made on technical grounds alone.

2. No basing mode is likely to provide a substantial number of survivable MX missiles much before the end of this decade. While some basing modes would permit the first missiles to be operational as soon as 1986 or 1987, these missiles could not be considered more survivable than the existing Minuteman missiles until additional elements of the basing system were in place.

3. MPS basing would preserve the existing characteristics and improve the capabilities of land-based ICBMs, but has three principal drawbacks.

- **MX missiles based in MPS would provide better accuracy and endurance, and comparable responsiveness, time-on-target control, and retargeting capability, when compared to other feasible basing modes.**
- Survivability depends on what the Air Force calls "preservation of location uncertainty" (PLU), that is, preventing the Soviets from determining which shelters hold the actual missiles. PLU amounts to a new technology, and while it might well be carried out successfully, **confidence in PLU will be limited until prototypes have been successfully tested.** Even then lingering doubts might remain.
- MPS basing cannot ensure the survivability of the missiles unless the number of shelters is large enough relative to the size of the Soviet threat. **The "baseline" system of 200 MX missiles and 4,600 shelters would not be large enough if the Soviets choose to continue to increase their inventory of warheads.** If the trends shown in recent Soviet force modernization efforts continue into the future, an MPS deployment of about 350 missiles and 8,250 shelters would be needed by 1990 to provide survivability. Although the number of missiles and shelters needed depends on what the Soviets do, the leadtimes for construction are so long that decisions on size must be made before intelligence data on actual, as distinct from possible, Soviet programs are available.
- **MPS would severely impact the socioeconomic and physical characteristics of the deployment region.** At a minimum, the deployment area would suffer the impacts generally associ-

ated with the rapid population growth in rural communities; but larger urban areas would also be affected by economic uncertainties regarding the size of the MPS construction work force and its regional distribution. The physical impacts of MPS would be characterized by the impacts of major construction projects in arid regions; but because the grid pattern of MPS would mean that a very large area would be close to construction activities, it is possible that thousands of square miles of rangeland could be rendered unproductive.

4. None of the variants of MPS would reduce the risks and uncertainties associated with PLU or significantly alter the number of the shelters required. However, split basing or the selection of a different deployment area would mitigate the regional impacts. The variants that OTA examined include changes from horizontal to vertical shelters, from "individual cluster" to "valley cluster" basing, and from Utah/Nevada basing to basing divided between Utah/Nevada and west Texas/New Mexico. A further variant would be to construct additional silos in the existing Minuteman basing areas to create a Minuteman/MPS system. This would be substantially cheaper than the proposed MX/MPS system, but would not be significantly quicker to construct.

5. A LoADS ABM system could effectively double the number of shelters in an MPS deployment provided two conditions were met. A LoADS system would have a high probability of shooting down the first Soviet warhead aimed at each MX missile, forcing the Soviets to attack each shelter with two warheads. The conditions for LoADS' effectiveness are: 1) PLU both for the MX and for the LoADS defense unit, and 2) survival and operation of the defense in the presence of nearby nuclear detonations. Since the LoADS defense unit would be concealed in a shelter and would be indistinguishable from the missiles and the decoys, LoADS deployment would compound the difficulties of PLU. These difficulties would be greater still if the LoADS addition were not planned at the time the MPS system was being designed. The LoADS defense unit would be required to endure nuclear effects of a severity unprecedented for so complex a piece of equipment.

A LoADS deployment would require the United States either to seek amendment of, or to withdraw from, the ABM Treaty reached at SALT I.

6. Basing MX missiles in silos and relying on launching the missiles before a Soviet attack could destroy them (launch under attack, or LUA) would be technically feasible, but it would create extreme requirements for availability of, and rapid decisionmaking by, National Command Authorities. A substantial upgrading of existing warning and communications systems would be required to ensure this capability against a determined Soviet attempt at disruption. Reliance on this capability would, however, impose extremely stringent requirements that the President be in communication with both the warning systems and the forces, and that an unprecedentedly weighty decision be made in a few minutes on the basis of information supplied by remote sensors. Finally, there would always be concern about whether the system was really immune to disruption or errors.

7. MX missiles based on small submarines would be highly survivable. Submarine-based MX would not be significantly less capable than land-based MX, but submarine-basing would involve a reorientation of U.S. strategic forces. An MX force based on small diesel-electric or nuclear submarines operating 1,000 to 1,500 miles from the U.S. coast could offer weapon effectiveness (i.e., accuracy, responsiveness, time-on-target control, and rapid retargeting) almost as good as land basing and would probably be adequate to carry out any strategic mission. A command, control, and communications (C^3) system to support submarine basing would be different from that used for landbasing but would not necessarily be less capable. However, submarine basing of MX would change the relative importance of land- and submarine-based strategic forces. Although OTA could find no scientific basis for predicting such an occurrence, the possibility cannot be excluded that an unexpected Soviet capability in antisubmarine warfare which threatened the U.S. force of Poseidon and Trident submarines might also threaten a force of MX missiles on small submarines. The cost of providing 100 MX missiles on alert at all times on a small submarine force would be roughly comparable to the cost of the baseline MPS system, and would be less than the cost of an MPS system sized to meet a larger Soviet threat. A significant problem is that such a force of small submarines could not be constructed quickly; existing U.S. submarine construction programs are already behind schedule, and it would require a number of years for a shipyard which is not building submarines to learn how to do so. It is therefore unlikely that initial MX deployment on small submarines could take place before 1990. However, the first MX missiles deployed would be survivable even before the rest of the deployment was complete.

8. An air-mobile MX—carried on wide-bodied aircraft and launched in midair—would be survivable provided that the aircraft received timely warning and took off immediately. Its dependence on prompt response to timely warning of submarine-launched ballistic missile attack would give such a force a common failure mode with the bomber force. (Removing dependence on warning by means of continuous airborne alert would be prohibitively expensive; acquisition and 10 years of operation for such a force could cost $80 billion to $100 billion (fiscal year 1980 dollars).) On the other hand, an air mobile force could not be threatened by the Soviet ICBM force unless the Soviets deployed many more ICBM *missiles* than they now possess and used them to barrage the entire Central United States. The outcome of such an attack would be insensitive to Soviet improvement in the fractionation and accuracy of their ICBMs. An air mobile MX force could not endure long after an attack if the Soviets attacked every airfield on which such planes could land to refuel. In this case, the National Command Authorities would have to "use or lose" the MX missiles within 5 to 6 hours of a Soviet attack. Providing endurance by increasing the number of airfields at which the planes could refuel would be enormously expensive ($10 billion to $30 billion for up to 4,600 airfields), and growth of the Soviet threat to plausible levels for the 1990's would require so many airfields that they would essentially fill the continental United States. The aircraft would have to takeoff to launch their missiles, which could mean slow response time, longer warning for the Soviets of a U.S. strike, and the possibility that the Soviets would mistake dispersal during a crisis for preparation for a U.S. first strike. Warning, communications, and guidance systems for an air-mobile force could be complex.

9. The problems associated with other basing modes studied by OTA appear more substantial. An ABM defense of MX missiles based in fixed silos against a large Soviet threat would require the use of a complex system based on frontier technology and potentially vulnerable to Soviet countermeasures. The technical risks appear too high to support a decision today to rely on such a system for MX basing. Basing MX on surface ships appears to offer no serious advantages and significantly less survivability than submarine basing. Basing MX in "superhardened" shelters (e.g., very deep underground) would likely involve a period of several days between a launch order and the actual launch of the missile. Rail mobile MX would involve problems of force management and vulnerability to peacetime accidents or sabotage. Road-mobile basing appears infeasible because of the size of the missile; off-road mobile basing appears to offer few advantages and several drawbacks compared to MPS.

10. In comparing MPS, MPS with LoADS, LUA, small submarine basing, and air mobile, it is found that:

- All offer reasonable prospects for feasibility and survivability. MPS depends for survivability on concealing its location (PLU) which creates a degree of technical risk, and which would be become still more difficult if LoADS is used to defend MPS.
- All are compatible with high weapon effectiveness for the MX missile, although MPS, MPS with LoADS, and LUA would provide slightly better accuracy than submarine basing or air mobile.
- MPS would endure in an operational condition for a long time if it survived; small submarines would endure for several months; air mobile might endure for only a few hours, depending on the nature of the Soviet attack; the endurance of LoADS would depend on the speed and effectiveness of surviving Soviet reconnaissance and retargeting capabilities; LUA would have no endurance at all.
- All are compatible with adequate C^3, but obtaining such C^3 for any of them would require time, effort, and money.
- MPS could complicate future arms control. MPS with LoADS would require amending or withdrawing from the ABM Treaty reached at SALT I. LUA, small submarines, and air mobile appear compatible with existing arms control concepts.
- MPS, or MPS with LoADS, would have an impact on both the socioeconomic and physical environment in the deployment region that would be so great as to be different in kind from the impacts of any of the other systems. LUA would have virtually no environmental impact. Impacts from submarine basing and air mobile would be relatively small and limited to the areas of the operating bases.
- Assuming a requirement for 100 surviving MX missiles, costs of baseline MPS, submarine basing, and air mobile would be roughly comparable: costs of acquisition and 10 years of operations for nominal designs are estimated to be roughly $40 billion (fiscal year 1980 dollars). Rebasing Minuteman III

in an MPS mode would cost 10 to 20 percent less. Growth in the Soviet threat would require increases in the costs of MPS systems, but not in the others. If the Soviet threat grew to a level OTA considers plausible for 1990, the United States could assure survivability of the MX/MPS either by adding LoADS (at an additional cost of $10 billion to $15 billion) or by expanding the number of shelters and MX missiles (at an additional cost of $15 billion to $20 billion). Continued growth of the Soviet threat into the 1990's would drive the cost of survivability as high as $80 billion. Costs of LUA would be the lowest: procurement of the MX missiles, modification of existing silos, and upgraded C^3 and warning systems could be $20 billion cheaper than the alternatives.

- MPS could provide a small, *non*survivable force by 1986 or 1987, and a large, survivable force by about 1990. MX deployment relying on launch under attack could begin in 1986, but completion of necessary upgrading of warning and C^3 systems would require several years longer. Air mobile could be deployed near the end of the decade. MPS with LoADS could be available around 1990. Small submarines could be deployed beginning around 1990, and would be survivable immediately. Thus, none of the basing modes could close the so-called "window of vulnerability" before the end of the decade.

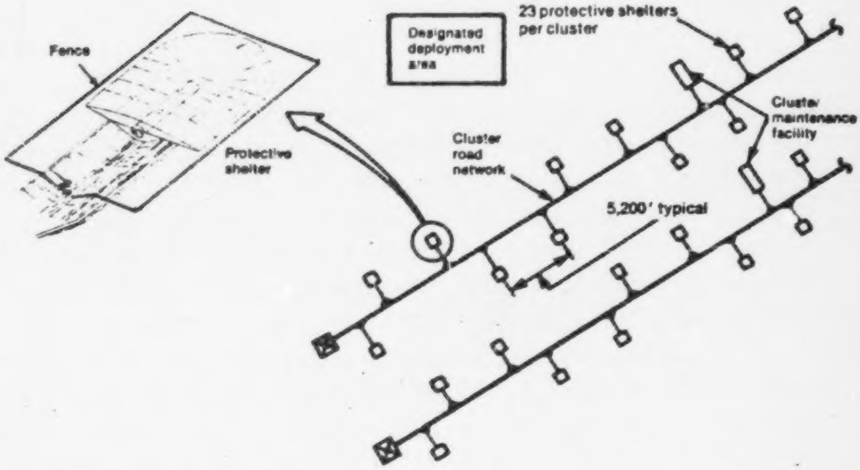
ELEVEN POSSIBLE BASING MODES

1. MX/MPS—The Current Baseline System

In the fall of 1979, the Carter administration selected a basing mode for MX and decided to proceed with full-scale engineering development. This design envisages the deceptive deployment of 200 MX missiles in 4,600 hardened concrete shelters. If the Soviets could not know which shelters contained the actual MX missiles and which contained missile decoys, they would have to target all 4,600 shelters in order to attack all 200 missiles. The baseline system would be located in the Great Basin area of Nevada and Utah and could be expanded by building additional shelters, additional missiles, or both.

The shelters would be spaced roughly 1 mile apart, and arranged in a linear grid pattern. (Fig. 1 illustrates the schematic layout of a single cluster.) Each of the 200 missiles would be based in

Conceptual Cluster Layout

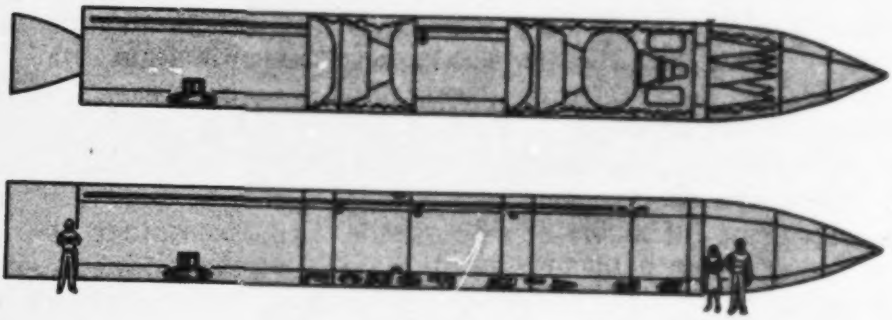

Fence
Protective shelter
Designated deployment area
23 protective shelters per cluster
Cluster maintenance facility
Cluster road network
5,200' typical

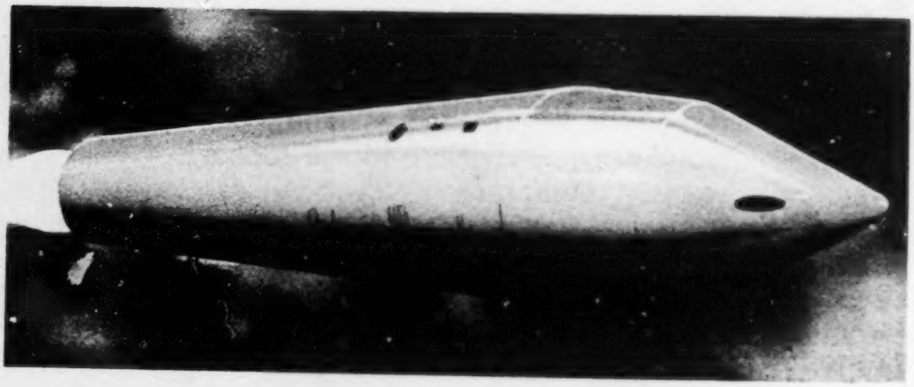
SOURCE: U.S. Air Force.

separate clusters of 23 shelters. The missiles would be transportable within each cluster but could not be moved from one cluster to another without removing large earthen barriers. Each shelter would resemble a garage or loading dock; the truck transporting a missile or decoy would back up to the shelter entrance, and insert the missile or decoy horizontally. Each cluster would thus contain 1 MX missile, 22 decoys, 23 shelters, 1 large transporter truck, and 1 maintenance facility. The truck would shuffle the missile and the decoys among the shelters in such a way that the Soviets would be unable to determine which shelter contained the missile. Missiles would also be transported for maintenance or, possibly, to facilitate arms control verification.

The MX missile in MPS basing has been designed to set a new standard in military capability. Its accuracy would be unprecedented. It could be rapidly retargeted in a variety of ways, and would have precise time-on-target control. MPS basing would give MX a very high alert rate and a long postattack endurance. As a system, MX/MPS would perform its military function providing that two conditions were met: 1) preservation of location uncertainty for the missile, and 2) adequate size to meet the Soviet threat.

MX Missile Characteristics





Missile Description

Length	71 feet
Diameter	92 inches (7 feet 8 inches)
Gross weight	192,000 lbs
Number of reentry vehicles	10

BEST COPY AVAILABLE

Preservation of Location Uncertainty (PLU)

The multiple shelters cannot ensure survival of the requisite number of missiles if the Soviets find out which shelters contain the missiles. PLU therefore involves making certain that the observable characteristics of missiles and decoys are so nearly identical that an outside observer cannot distinguish them. This entails a major new engineering task, driven by the high sensitivity of present-day and future sensors and by the many observable signs of the missile's presence. As an example of PLU engineering, the missile decoy might contain an appropriate quantity and distribution of high-permeability metal to help make it impossible to distinguish the missile from the decoys by means of a metal detector.

Dealing with this and dozens of other potentially observable signatures makes PLU the equivalent of a new technology, which is wide in scope and intensive in detail. It would require the integration of administrative, operational, and technical considerations. One cannot have confidence in the success of this "new technology" before equipment prototypes are field-tested, because even fine details of missile signatures are important for adequate missile concealment. Furthermore, after the system is fully designed, tested, and deployed, lingering doubts could remain that would limit confidence in the system. Even small doubts could be important, since a catastrophic breakdown in PLU (e.g., a technique whereby the Soviets could determine the exact location of the missiles by satellite observations) would make it relatively easy to attack all the MX missiles; a more limited breakdown, while not imperiling the entire system, could improve the effectiveness of a Soviet attack and reduce the weight of a U.S. retaliation. On the other hand, the Soviets' task of "breaking" PLU could be difficult as well. For the Soviets to attack the system on the basis of their own counter-PLU efforts might entail considerable risk and uncertainty on their part.

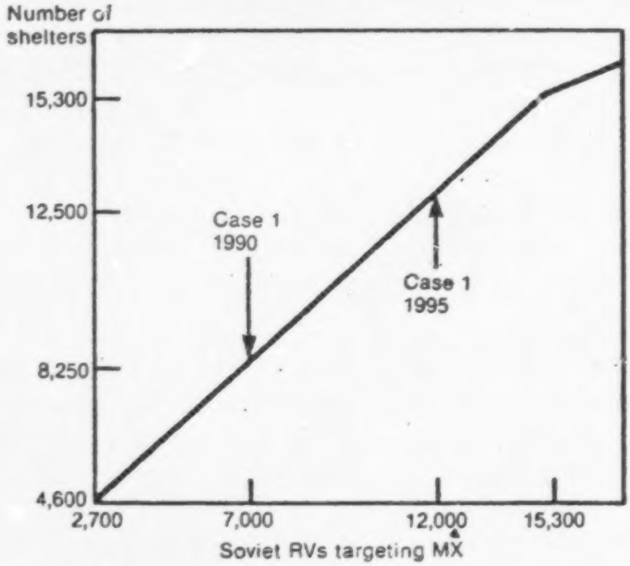
Except during missile transport, the proposed baseline system would not restrict public activities outside the 2.5-acre sites surrounding each shelter. While barring the public from a larger area might be infeasible, restrictions on public activities, including mineral exploration and development, could be necessary. From a technical standpoint, the nature and extent of these restrictions depends on the degree of success of the Air Force PLU program.

Adequate Size in the Face of Threat Growth

The principle of an MPS system is that survivability is maintained by having more shelters than the enemy is able to target. It is therefore necessary to estimate the number of RVs (reentry vehicles carrying a nuclear warhead) which the Soviets could use to attack the MX/MPS system, and to ensure that the number of shelters is sufficiently large. Since the Soviets have other high-priority targets (bomber bases, submarines in port, etc.) and presumably want to retain a force in reserve, the number of RVs available to attack MX would be somewhat less, perhaps several thousand RVs less, than the total number of Soviet RVs.

Any effort to estimate the size of and composition of future Soviet forces is highly uncertain—U.S. intelligence is far from perfect, and in some cases the Soviet leaders themselves may not yet have made key decisions. OTA has sought an approximation of the threat by making a series of conservative assumptions, most notably that the trends of the 1970's in the rate of Soviet development and deployment of their ICBM force continue through the 1980's and the 1990's. On this assumption, it is estimated that the Soviets could have 6,000 to 7,000 RVs available to attack

MPS Shelter Requirement
(100 Surviving Missiles)



Assumptions:
- 1 missile for every 23 shelters
- Damage expectancy 0.85

SOURCE: Office of Technology Assessment

MX/MPS by 1990, and 11,000 to 12,000 RVs available by 1995. By the year 2000, 15,000 or more Soviet RVs could be aimed at an MX/MPS deployment. This assumes that approximately 3,000 additional Soviet RVs would be reserved for other counterforce targets, such as Minuteman silos, and that an additional force of Soviet strategic weapons would be allocated to attack or threaten U.S. cities and industry.

One can calculate of the approximate number of shelters needed to ensure the survival of 100 MX missiles against the projected Soviet threat. For example, if we assume the 1990 threat of 7,000 RVs targeted against MX, an 85-percent probability of RVs reaching their targets, a deployment of 1 missile for each 23 shelters, and no ballistic missile defense, then this would require a deployment of 360 missiles among 8,250 shelters. Similarly for the 1995 threat of 12,000 RVs, the same survival requirement could be met with 550 MX missiles among 12,500 shelters.

An alternative assumption is that, faced with the threat that MX would pose to their silos, the Soviets would devote their efforts to providing survivable basing for their existing ICBM force, rather than to expanding their RV inventory in order to attack MX/MPS.

The existing schedule for the baseline case calls for completion of 4,600 shelters by 1989, although it does involve some optimistic assumptions. Continuation of the planned construction rate (roughly 100 shelters per month) would mean that it would be 1992 before the level of 8,250 shelters was approached, and by then 8,250 could be insufficient. By 1995 the number of shelters constructed (at a rate of 100 per month) would be just under 12,000 —still somewhat less than the number of available Soviet RVs. Clearly, a response to a Soviet effort to overwhelm MX calls for either an ABM system (discussed below) or a higher construction rate.

A large MPS system which was too small to retain survivability could still have some value as a means of limiting Soviet options. It would still oblige the Soviets to use a large fraction of their strategic forces to destroy a somewhat smaller fraction of U.S. strategic forces. However, if the Soviets "fractionate"—i.e., put a larger number of smaller warheads on their large missiles—then the Soviets might be willing to accept an unfavorable exchange ratio because they could "afford" to expend a large number of RVs in order to destroy a smaller number of RVs that constituted the entire U.S. ICBM inventory. In any case, it is clear that an

BEST COPY AVAILABLE

MPS that was far too small, say half as many shelters as available Soviet RVs, could not be considered at all survivable, and would be of little greater value than single shelter basing.

With the same reasoning, an MPS system that requires a number of years to build would not reach survival value until the number of operational shelters exceeded the number of Soviet RVs available to attack them. If one assumes that the number of available Soviet RVs may grow from year to year, then the time when U.S. MPS construction actually began and the rate at which shelters were constructed would both be critical. Since building additional shelters would require time, including time to plan the additional building program, the United States would require a prediction several years in advance of the size of the Soviet threat against MX.

The Air Force has estimated that a construction rate of 2,000 shelters per year (about 165 per month) would not exceed projected construction resources, although there would be an additional $400 million in front-end costs (e.g., additional cement factories). Assuming this construction rate, to start construction in 1986 would bring the United States to the required shelter level sometime in 1991, and it might not be difficult to stay ahead thereafter. However, it would be necessary to decide by 1983 (or 1984 at the latest) that a 2,000 shelter per year construction rate would be needed, and it is not clear that by 1983 the United States will have a reliable estimate of the path which Soviet ICBM deployment will have taken by 1990. Furthermore, the United States could *not* first build a 4,600-shelter system and then decide to expand it if it proved to be too small, unless the United States were prepared to defer survivability into the mid- 1990's. Therefore, the completion date, size, regional impact, and cost of an MPS system would all depend in part on what the Soviets chose to do, and on the accuracy of the U.S. estimates of future Soviet programs.

It is possible that the Soviet decision about whether to attempt to overwhelm MX/MPS with large numbers of RVs would depend on Soviet estimates of their chances for success. U.S. construction of MX/MPS at the baseline rate might tempt the Soviets to deploy more RVs in order to "stay ahead," while a U.S. decision to build a larger deployment at an accelerated rate might persuade the Soviets that deploying many more RVs was pointless. In this case, the expansion of the program would make itself unnecessary, but the United States would probably realize this only after incurring the greatly increased costs and regional impacts of expansion.

Regional Impacts

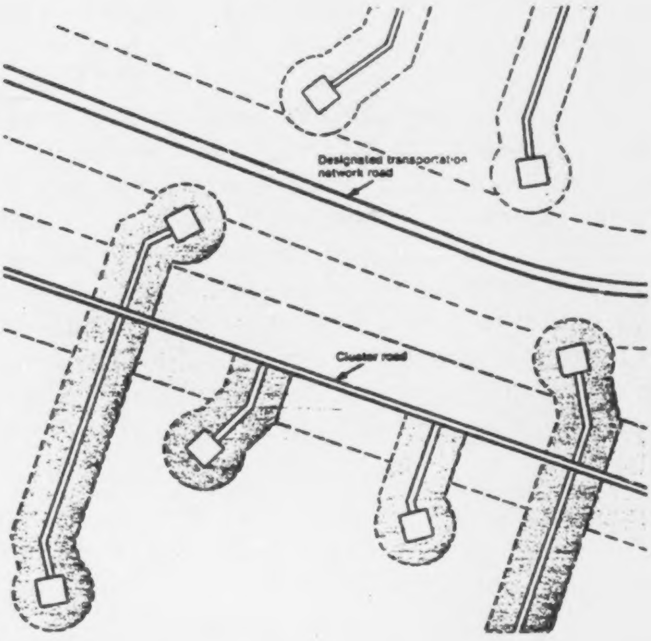
The regional impacts of the proposed MPS basing system would be severe and could include the long-term loss of thousands of square miles of productive rangelands. However, the severity of these impacts would result as much from the site selection criteria as from the nature of the basing system and could be mitigated, in part, by variants of the proposed system.

MPS construction would require a work force ranging in size anywhere from 25,000 to 40,000, depending on construction techniques, program decisions, and the total number of shelters required by 1990. The total associated population could be as high as 250,000 people. Because MPS siting criteria require minimum population densities, this influx of people would necessarily overwhelm the social infrastructure and severe impacts would result within the deployment area. The overall impacts would include potential economic benefits; but experience with rapid growth throughout the West suggests that most of these benefits would go to in-migrants with specialized skills, while unemployed residents of the deployment area, women, minorities, and Indians, would be least likely to benefit. At the same time, the economic restructuring of the region would adversely impact many local businesses. The cultural values of isolated communities with integrated social structures would also be subject to severe disruption.

In the larger urban areas on the periphery of the deployment area, MPS would have different effects. Although these areas might have sufficient social infrastructures to absorb rapid population growth, uncertainties regarding the potential size of the MPS related population increase and their geographic distribution would preclude effective growth management. As a result, investment planning in both the public and the private sectors would probably fail to minimize the adverse impacts or maximize the potential benefits of MPS deployment. Finally, smaller communities affected by planned energy developments in surrounding areas could be impacted by MPS if the resource and manpower requirements contribute to delays in energy project schedules.

The physical impacts of MPS would necessarily involve the disruption of 200 square miles of land area for construction of

Potential Vegetative Impact Zone



shelters, roads, and support facilities. In a deployment area with moderate rainfall and agricultural productivity, the major impacts of construction might be confined to the loss of those lands and related wildlife habitat, but other lands temporarily disturbed by construction activities probably could be revegetated. In "least productive" agricultural lands such as the Great Basin, however, the arid environment would inhibit revegetation and effects could spread to adjacent lands. In the absence of irrigated revegetation, or if subjected to continued disruption from PLU surveillance activities and random off-road vehicles, these lands would not recover. Consequently, thousands of square miles of productive rangeland could be desolated and the ecology of the entire region irreversibly degraded.

Institutionally, the use of Federal lands would raise many complicated questions of landrights, oil and gas leases, mining claims, grazing permits, and Indian land claims, resulting primarily from potential conflicts between PLU requirements and economic activities such as mineral exploration and development. If private lands are used, most of these questions could be circumvented by negotiation of easements with explicit provisions for PLU, definitions of compatible land uses, and covenants regarding the resale of properties and rights, although the process of negotiation might delay the project schedule.

Civilian Fatalities

OTA arranged for calculations of the number of civilian fatalities due to radiation fallout that would result from a Soviet nuclear attack on an MPS deployment in Utah and Nevada. The results depend to a very large degree on windspeed and direction, causing calculated fatalities to range from less than 5 million to more than 20 million. However, it seems quite probable that a Soviet nuclear attack on MX would be likely to include Minuteman and Titan missile fields, strategic bomber bases, and submarines in port. Because these existing targets are distributed over a large area, the *added* fallout-related fatalities due to the additional targets in the MPS fields would have a likely range from less than 1 million to 5 million. Total fatalities for this general attack have been estimated to range from 25 million to 50 million people.

Fatalities due to fallout would be a major part, but not the only measure, of damage caused by a nuclear attack. For a discussion of other consequences, and of the uncertainties involved, see OTA's earlier study, *The Effects of Nuclear War.*

Cost

All present cost estimates must be qualified; apart from the usual uncertainties of estimating future costs of unprecedented programs (which mean that all estimates have at least a 10-percent error factor), there are some design decisions that have not yet been made which would have an impact on costs. Nevertheless, OTA reviewed the Air Force cost estimates and prepared an independent estimate using a comparable methodology. OTA's estimate of $37.2 billion (fiscal year 1980 dollars) for acquisition costs of the system is within 10 percent of the Air Force estimate of $33.8 billion (fiscal year 1980 dollars) and is within the accepted range of uncertainty. In order to permit fair comparison with other possible basing modes, an estimate was made for the cost of: (a) acquisition plus (b) operating costs between initial operating capability (IOC) and final operating capability (FOC), plus (c) the cost of operating the full system for 10 years after FOC. This 10-year lifecycle cost was $43.5 billion (fiscal year 1980 dollars). Note that neither the Air Force estimate nor the OTA estimate includes the costs of mitigating regional impacts. The socioeconomic impacts could amount to several billion dollars, which would be divided in some way among the Air Force, local and State governments, and individuals and firms in the area. The costs of irrigation to permit revegetation, if this were undertaken, could be several billion additional dollars.

OTA also estimated the cost of an expanded system. The estimated cost of a system of 8,250 shelters and 360 missiles, completed by 1990 is $62.4 billion (fiscal year 1980 dollars). The cost of a system of 12,500 shelters and 550 missiles, completed by 1995, was estimated at $82.6 billion (fiscal year 1980 dollars).

At the request of the Senate Appropriations Committee, the Congressional Budget Office (CBO) made similar estimates. Their assumptions were coordinated with OTA, but they made use of an Air Force parametric cost model. CBO estimates of system acquisition costs for 325 missiles in 8,570 shelters (the least costly mix for the 1990 threat) were $49 billion (fiscal year 1980 dollars), compared to OTA's estimate of $52.9 billion for acquisition costs. For the 1995 OTA projected threat, CBO estimated a system acquisition cost for 410 missiles and 13,510 shelters (the least costly mix) of $66 billion (fiscal year 1980 dollars), compared to OTA's estimate of $71.1 billion for acquisition costs. CBO further estimated that if a LoADS ABM system were deployed to meet the 1990 threat, system acquisition costs for 225 missiles, 5,370 shelters, and 225 LoADS defense units (the least cost mix) would be about $44 billion (fiscal year 1980 dollars), or about 10-percent less than an undefended system for the same threat level.

Schedule

The present Air Force schedule calls for IOC in mid-1986, and FOC by the end of 1989. OTA reviewed the milestones which this schedule would require, and believes that the schedule for IOC, while possible, is quite optimistic. Any unforeseen delays, including delay in a firm administration decision on MX basing mode after July 1, 1981, would almost certainly result in slippage in IOC. On the other hand, a delay of some months in IOC need not lead to a corresponding delay in FOC. Slippage in IOC by 1 year, without significant change in FOC, would increase acquisition costs by about $1 billion (fiscal year 1980 dollars). OTA considers this a likely scenario.

2. MX/MPS: Vertical Shelters

There is technical disagreement over whether MPS should have horizontal or vertical shelters. On the one hand, if missiles need to be quickly relocated, it appears that missile relocation takes less time with horizontal shelters than with vertical shelters because missile insertion for horizontal shelters is somewhat simpler. On the other hand, the United States has more experience with, and understanding of, vertical shelter; and pound for pound of concrete, vertical shelters are more resistant to nuclear weapon effects than horizontal shelters. As a result, less land area might be required for a given number of shelters. Still, it appears that with adequate field tests, horizontal shelters could be built to withstand the expected nuclear environment with confidence.

There is no particular reason to believe that PLU, arms control verifiability, or addition of an ABM system would be significantly easier or more difficult if a shift were made from horizontal to vertical shelters. However, about a year of intensive engineering development has taken place on the basis of a decision to use horizontal shelters. Much effort has gone into design of PLU and ABM components, and this effort would have to be done over. Apart from the loss of time, real confidence in vertical shelter PLU or vertical shelter ABM would have to await the results of this design effort.

OTA estimates that the lifecycle costs for a 4,600-vertical-shelter system with a 1989 FOC would be reduced by about $1.5 billion (fiscal year 1980 dollars) if the shift were made to vertical shelters now.

3. Valley Cluster Basing

A variant of the baseline system, which has received serious consideration within DOD during the first part of 1981, is to replace "individual clusters" with "valley clusters." This would mean creating a single large cluster in each valley, establishing the roads so that it would be possible to move a missile between any two shelters in the same valley. This is in contrast to the baseline arrangement in which only 1 missile has access to each group of 23 shelters, and each missile can be placed only in one of its "own" 23 shelters. Valley clustering would not alter the design of the missiles, shelters, or transporter trucks.

This change would have the following effects:

1. It would require fewer maintenance facilities. Instead of 1 facility per cluster of 23 shelters (required because the transporter trucks could not carry missiles from one cluster to another), there could be only one or two facilities per valley. This would save money in both construction and operation.
2. It would require fewer transporter trucks. Instead of one transporter per missile, it would be possible to have one transporter for several missiles. This would save money, but it would mean that reshuffling all the missiles and decoys would take longer, and it would limit the possibility of "dash to shelter" as a fallback mode if PLU were broken.
3. It would have only marginal effects on PLU.
4. It could make arms-control verification more difficult. While it would probably not affect the difficulty of clandestinely introducing additional missiles into the deployment area (i.e., putting missiles in shelters that are supposed to contain decoys), it would make it most difficult to verify after the fact that such cheating had or had not taken place. Since this drawback is the same as the drawback of saving money by eliminating the so-called "SALT ports" (openable hatches in the tops of shelters designed to facilitate verification), valley clusters and elimination of SALT ports (which would save money) appear to some as an attractive combination.
5. Valley clusters would not change the principal regional impacts.

On balance, shifting to valley clusters, if combined with the elimination of SALT ports, might save close to $2 billion (fiscal year 1980 dollars), at the cost of slower reshuffling and more difficult verification.

4. Split Basing MPS: Nevada/Utah and West Texas/New Mexico

Split basing would locate half of the shelters in the Great Basin of Nevada and Utah, and half in the Southern High Plains of west Texas and New Mexico. The rationale would be to mitigate the adverse regional impacts—both socioeconomic and physical—by making the deployment in each region smaller.

Split basing would mitigate some of the adverse impacts of MPS. The mitigation would arise from the likelihood that the rapid changes created by MX/MPS construction could be below thresholds where they become difficult or impossible to manage in the available time. However, if the baseline shelter number (4,600) and construction rate (roughly 1,200 per year) proved inadequate, then split basing would probably not mitigate the impacts, but might make system expansion easier because plenty of suitable land would be readily available. Split basing could complicate issues of land acquisition, since the land to be used in Nevada and Utah is largely public land, while the land in west Texas and New Mexico is largely in private hands.

Split basing would increase the costs of both construction and operation by about 7 to 10 percent.

5. MX/MPS With a LoADS ABM System

An alternative to increasing the number of shelters in the face of an expanded Soviet threat would be to provide the MPS system with a ballistic missile defense. The Army's LoADS has been proposed for the role of defending an MPS system.

The LoADS defense unit (DU), consisting of a tracking radar and nuclear-armed interceptor missiles, would be designed to fit in the shelters and appear just like an MX missile or a decoy to outside observers or sensors. A DU would be hidden in each cluster of shelters and programed to defend the shelter containing the MX missile. The DU might also have to defend itself. When it became apparent that a Soviet attack was on the way, the DU would break through the top of the shelter and prepare to fire.

The Soviets would have to target two warheads at the shelter containing the MX missile, since the first one would be intercepted by LoADS with high probability. Since the Soviets would not know which shelter contained the MX, they would have to target two RVs against *each* of the shelters in the cluster. Thus, addition of LoADS to the baseline MPS system would double the price the attacker would have to pay to destroy an MX missile from 23 to 46 RVs. The effect would be the same as doubling the number of shelters while keeping the number of missiles the same.

It is possible to have high confidence that LoADS would exact a price of 2 RVs per shelter *if* the locations of LoADS DUs and the MX missiles could be concealed and *if* the DU could be hardened to survive the effects of nearby nuclear detonations. This confidence, conditional upon successful deception and nuclear hardness, results both from advances in ballistic missile defense (BMD) technology in the last decade and from the relatively modest goal of exacting from the Soviets one more RV per shelter.

Successful deception would be essential for LoADS defense, since if the Soviets found out which shelter contained the DU, they could attack that shelter first, force the DU to use up all its interceptors in self-defense, and then attack the remaining shelters using one RV per shelter. The situation would be far worse if detection of the DU somehow made it feasible for the Soviets to locate the MX missile as well. Since the DU would be a functional object—not just a decoy that could be designed in any way that would make it indistinguishable from a missile to Soviet sensors—PLU would become considerably more complex if LoADS were added to MX/MPS. It would probably be necessary to alter some features of the MX missile cannisters and the decoys to mimic distinctive features of the LoADS DU. Because of this possibility, a deferred decision to deploy LoADS (made after the dimensions of the future Soviet threat became clearer) would entail more risk and cost unless the MPS system had been designed with the LoADS addition in mind.

The LoADS DU would have to survive and operate in a nuclear effects environment unprecedented for so complex a piece of equipment. Measures taken to protect the DU would furthermore have to be consistent with the severe design constraints imposed by PLU. It is not possible to have confidence that the goals of PLU and nuclear hardening can be met—separately, much less simultaneously—until detailed design and testing are done.

There is a variety of ways in which the Soviets might respond to deployment of LoADS, involving both special attack strategies and new weapon systems, which could pose a threat to the defense's effectiveness. These so-called "reactive threats" are discussed in the body of this report and its classified annex. The risks to LoADS' effectiveness (in forcing the Soviets to target each shelter twice) from these threats appear to be moderate.

Because LoADS would be integrated into the MPS system, the environmental impacts would be essentially the same as for baseline MX/MPS.

LoADS' DUs which were mobile or which contained more than one interceptor missile per DU could not be developed outside of the laboratory, tested, or deployed within the terms of the ABM Limitation Treaty reached at SALT I. Pursuing this option from the present technology development stage into prototyping or deployment would require amendment or abrogation of the Treaty. The diplomatic and political consequences of seeking amendment or unilaterally withdrawing from the Treaty are beyond the scope of this study. Amendment or abrogation would give the Soviets the legal right to develop and deploy an ABM system of their own. A Soviet ABM deployment might create a situation in which the United States felt it needed more surviving MX missiles, and hence a larger deployment, to be sure of destroying defended Soviet targets.

6. MPS Deployment of Minuteman III

A related possibility would be to construct additional silos or shelters in the existing Minuteman III fields, and modify the Minuteman III missiles to permit them to be moved around deceptively and concealed among the available shelters. The rationale for such an option would be to use the MPS concept to make the existing Minuteman III missile survivable, thereby saving time and money. Such a system might replace MX altogether, or it might serve as a precursor system, with MX gradually replacing Minuteman III missiles in the new MPS field. It could also serve as an interim measure, providing survivable land basing until some other mode of MX basing was ready.

Such a system appears to be technically feasible. The existing Minuteman III missiles and launch-support equipment would be cannisterized separately to facilitate movement among protective shelters. New transporters for the Minuteman missiles and associated equipment would have to be procured, and roads in the deployment area would have to be upgraded. It would also be necessary to design a system for maintaining Minuteman PLU similar to but not identical to the system of maintaining PLU for the MX. Minuteman PLU would have similar technical risks and uncertainties, although the institutional problems would be altered by the predominance of private lands. The regional impacts would be similarly altered, and OTA's analysis suggests that both the range of likely impacts and the probability of extremely severe impacts would be reduced. It would be possible, at additional cost, to replace the existing guidance system with the new AIRS (advanced inertial reference sphere) guidance system being designed for MX; this would upgrade the military capability of Minuteman III to the level of the MX missile, except that since each missile would carry fewer warheads, more missiles would be required for an equivalent capability.

Cost and schedule are of particular interest in considering an MPS rebasing of Minuteman III, since this basing mode was originally proposed as a "quick fix." Assuming a firm decision in July 1981, it appears that Minuteman MPS could not be deployed on a faster schedule than MX/MPS. Because of the need to replicate for Minuteman the design work already done on PLU for MX, and the need to begin the environmental impact statement and land acquisition processes, construction for Minuteman rebasing probably could not begin before the spring of 1985, and FOC for a survivable 5,800-shelter Minuteman MPS system would probably be in the spring of 1989. Cost of a Minuteman MPS would be less than the cost of MX/MPS. OTA estimates that Minuteman MPS system composed of 5,800 shelters and 667 missiles, which would have roughly equivalent survivability to baseline MX/MPS and existing silo-based Minuteman, could be built and operated for about $36 billion, or roughly $7 billion less than MX/MPS (fiscal year 1980 dollars). This would include reopening the Minuteman production line to provide test missiles and spares, but would not include the cost of retrofitting the MX guidance system (AIRS) on to the Minuteman III missiles. If the systems had to be augmented (whether by expansion, by adding LoADS, or both) to meet an expanded Soviet threat, the cost advantage of Minuteman III MPS would diminish somewhat.

Expanding a Minuteman MPS system to maintain survivability against an expanded threat would require a substantial increase in the total number of U.S. multiple independently targeted reentry vehicle ICBMs. This would run counter to the approach to offensive arms control which both the United States and the Soviets have espoused during the last decade of SALT negotiations.

7. Launch Under Attack

Another approach to MX survivability (or, for that matter, Minuteman survivability) is to base the missiles in fixed silos, accept the vulnerability of these silos, and resolve to launch the missiles before attacking Soviet RVs could arrive to destroy them. Such a posture is known as launch under attack (LUA). Adopting this approach to basing MX would mean choosing to *rely* on LUA.

To have high confidence in the technical aspects of LUA, the United States would have to begin by substantially upgrading the systems that provide warning of an attack and emergency communications. OTA's analysis indicates that providing sensors and communications links that were highly reliable in the face of Soviet efforts to destroy or disrupt them is feasible but would require time, money, and continued effort. Almost all improvements in this area could be deployed by the end of the decade at a cost of several billion dollars. The total cost of this basing mode, including the MX missiles, might be about half that of baseline MPS. Some of the systems required for LUA would be desirable, or perhaps even necessary, for other basing modes as well.

Once this were done, we could have high confidence that LUA was technically feasible *provided that* National Command Authorities (i.e., individuals empowered to order the launch of the MX missiles) were in communication with a command post at the moment the Soviet attack was detected so that they could assess its meaning, decide how to respond, and communicate a launch order to the forces in a short period of time. Whether the President would be available at all times for this purpose, or delegate his most awesome authority to someone who was, is clearly not a matter of technology but of decision at the highest level of government.

Apart from this question, LUA has several attractive features as an MX basing mode. Because existing silos could be modified for use by MX missiles, there need not be any major environmental or societal impact. The cost would be lower than for any other MX basing mode, and deployment could take place as soon as MX missiles were produced. LUA would preserve familiar features of silo basing, including weapon effectiveness as measured by accuracy, time-on-target control, retargeting capability, and the like; familiar force management procedures; and familiar arms control verification procedures. The same targets (and perhaps more) would be available in the first few minutes of a war as in the first few hours or days. An LUA force could therefore participate in U.S. war plans in any role except that of a secure reserve force.

Reliance on LUA also has some serious drawbacks. Decision time would be very short. Depending on the circumstances, decisionmakers could lack crucial information regarding the extent and intent of the Soviet attack—e.g., information about targets which the Soviets had chosen not to attack. Such information could be necessary to gage the proper response. Decisionmakers would also lack an interval between attack and response during which an effort could be made to assess intelligence information, consider diplomatic measures, and signal the intent of the U.S. response.

No matter how much money and ingenuity were devoted to designing safeguards for the U.S. capability to launch under attack, and even if these safeguards were very robust indeed, it would never be possible to eradicate a lingering fear that the Soviets might find some way to sidestep them.

Finally, despite all safeguards, there would always remain the possibility of error; depending on the nature of the error, it could mean a successful Soviet first strike against MX or it could mean a nuclear war started by accident.

8. Silo-Basing With an ABM Defense

For defending a relatively small number of targets such as MX silos, an ABM system that operates outside the atmosphere is preferable in theory to a low altitude defense system. This is because an exo-atmospheric (or "exo") defense could intercept many RVs headed for a single silo, whereas after a small number of intercepts an endo-atmospheric ("endo") system would find further defense precluded by the effects of its own and attacking nuclear weapons. A combination of exo and endo—a so-called layered defense—is an attractive concept because the principal limitation of each layer could be alleviated by the presence of the other: the exo defense would break up the dense and structured attacks which could otherwise overwhelm an endo defense, while an endo defense could cope with the relatively few enemy RVs that would almost certainly "leak" through the exo defense.

The Army's concept of exo defense, called the "Overlay," is in the technology exploration stage. No detailed design is available, such as exists for LoADS. In outline, the concept consists of interceptor missiles roughly the size of offensive missiles, equipped with infrared sensors, and carrying several kill vehicles, also equipped with infrared sensors. The interceptors would be launched into space, where the infrared sensors would detect approaching RVs as warm spots against the cold background of space. The kill vehicles would be dispatched to destroy the RVs either by colliding with them directly or by deploying a barrier of material in their path.

Because no specific system based on the Overlay concept has been worked out, it is not possible to analyze in detail the effectiveness of the Overlay in various attack scenarios. It is clear that high efficiency would be required if it were to be able to defend a small number of MX missiles against a large Soviet attack. There are at present many uncertainties about whether the Overlay could achieve the high performance it would require to satisfy the needs of MX basing. These uncertainties concern both the underlying technology and the defense system as a whole. The technical risk associated with layered defense based on the Overlay is therefore high—substantially higher than the risk associated with LoADS.

In addition to uncertainties and consequent risk associated with the Overlay, there is a potential "Achilles' heel" in the vulnerability of infrared sensing to decoys and other penetration aids. Unlike the LoADS radar, which could measure the weight of approaching objects after they entered the atmosphere, the Overlay's infrared sensors would measure their temperature characteristics. Lightweight decoys could be made which resembled in their temperature characteristics the heavier RVs.

The Overlay is not a system that is developed and ready for the role of defending silo-based MX. As the concept matures, it will have to deal with the fundamental problem of decoy discrimination as well as with the design of a specific working system. For the moment, it would be quite risky to rely on the Overlay, or on layered defense, as the basis for MX basing.

As in the case of LoADS, development or deployment of an Overlay or layered defense would require amendment or abrogation of the ABM Treaty reached at SALT I.

9. Basing on Small Submarines

It would be technically feasible to build, deploy, and logistically support a fleet of small MX-carrying diesel-electric-powered submarines. These submarines could operate within 1,000 to

1,500 nautical miles of three bases, located on the east and west coasts of the continental United States and on the coast of Alaska. These submarines would be highly survivable against all existing antisubmarine threats, and against all future antisubmarine warfare technologies which OTA was able to project. An alternative means of propulsion, using inexpensive low-powered nuclear reactors, is also possible.

At present, no detailed design exists for a submarine force specifically optimized to have flexibility, responsiveness, and accuracy comparable to that of the ICBM leg of the Triad. In order to provide a basis for analyzing the degree to which these attributes could be achieved in a submarine-based MX, OTA has postulated a system optimized for this purpose. The system postulated uses proven technologies and existing U.S. Navy operational practices wherever possible, and therefore differs in some respects from the "SUM" concept developed by Sidney Drell and Richard Garwin.

The system assessed by OTA would consist of 51 moderate-sized diesel-electric submarines, each of which carries 4 MX missiles. The missiles in their capsules would be carried horizontally outside the pressure hull. During normal operations about 28 submarines would be at sea at all times, while the remainder would be in port for refits or overhauls. The submarines would have pressure hull displacements comparable to that of existing U.S. and Allied diesel-electric submarines. If an operational need arose, the submarines would have sufficient size, speed, and endurance to operate at distances in excess of the proposed 1,000 to 1,500 nautical miles from bases.

Small submarine basing raises two quite different kinds of issues. The first class of issues relates to whether or not small submarine basing is appropriate for MX; the second class of issues are technical questions about the extent to which such a basing mode would enable MX to meet the requirements for which it is being designed.

Placing the MX missile on board submarines would mean that well over half of the U.S. strategic force of the 1990's would be submarine-based. This would obviously exacerbate the problems that would develop if—contrary to expectations—the Soviets were to develop an antisubmarine warfare capability that was effective against ballistic missile submarines. It would not be possible to build a new fleet of submarines without an expansion of U.S. submarine shipbuilding capacity. It would be necessary for three shipyards that do not now build submarines to learn how to do so. Submarine construction is quite complex, and involves more exacting quality control than surface ship construction. Delays could occur if the shipyards have difficulties in implementing the necessary quality control and construction techniques, or if the industrial base supplying certain critical materials is not expanded fast enough. Problems in recruiting and retaining enough skilled and dedicated personnel to man such a fleet could drive up costs.

There is no particular reason why the existing Minuteman force would have to be taken out of service as soon as MX was deployed on submarines, and so the land-based ICBM leg of U.S. strategic forces would continue to exist. (Existing plans for, and OTA analyses of, other basing modes assume the continued operation of Minuteman after MX deployment.) However, its relative weight would be diminished, and this could have political significance. There is a school of thought which holds that basing a major portion of U.S. strategic forces on U.S. soil (so-called "sovereign basing") makes a significant contribution to deterrence. Moreover, changing the relative weight of land- and sea-based forces would create institutional problems for both the Air Force and Navy.

On the other hand, submarine basing of MX could lend an element of stability to the arms race, since a Soviet counter would involve increasing their already high level of effort in the apparently unpromising area of strategic antisubmarine warfare rather than increasing the number of their nuclear weapons. Submarine basing would be fully compatible with existing arms control concepts and verification procedures. The technical risks would be low.

OTA's analysis focused on those aspects of submarine basing where it is possible to make comparisons with other basing modes: survivability, accuracy, responsiveness (including the effectiveness of command, control, and communications), environmental impact, cost, and schedule.

In brief, OTA could find no existing technology, and no technology is believed to be on the horizon, which offers any promise for permitting an effective Soviet attack on a fleet of small MX-carrying submarines. However, the possibility that the Soviets may discover and deploy some antisubmarine warfare technology which cannot be foreseen cannot be excluded. If this were to happen, the differences between the Trident fleet (a small number of high-speed boats operating in an enormous deployment area) and the MX fleet (a large number of slower boats operating relatively close to the United States) could make it more difficult, and perhaps impossible, for the Soviets to deploy an antisubmarine warfare force capable of attacking both U.S. ballistic missile submarine forces.

"Endurance" is defined as the ability to survive for weeks and months *assuming* that a system has survived for a few days. The small submarines which OTA envisaged would have to return to a port (or conceivably an at-sea tender) 1 to 4 months after an attack, depending on how long each submarine had already been at sea when the attack took place.

Submarine-based MX missiles could achieve accuracies close or equal to the engineering-design requirements for the land-based MX missile. While it appears likely that land-based MX accuracies would exceed these requirements, submarine-based systems may well have such high damage expectancies against very hard targets that further improvements in accuracy would not have military significance.

OTA could find no reason to believe that the construction of three new submarine bases would have environmental impacts unlike those associated with comparable construction projects in coastal areas. In this case, the impacts would be confined to the immediate areas surrounding the three operating bases, and should be manageable.

Any estimate of the cost of small submarine basing can only be approximate, since no detailed design exists. Acquisition cost of the system described here is estimated to be about $32 billion (fiscal year 1980 dollars), with another $7 billion to operate the system until 2000.

Construction of submarines is a complex and specialized task, involving rigorous quality control and specialized materials not normally required for shipbuilding. At present there are only two shipyards in the United States capable of building submarines, and both are backlogged. Bringing additional shipyards to the point where they could build submarines, and obtaining the necessary parts and materials, would probably involve substantial delays. OTA estimates that the first such submarine could not be operational before 1988 at the very earliest, with 1990 a more realistic date. Four more years would be needed before the force reached the number of 51. Efforts to accelerate this schedule (or, if things went wrong, to maintain this schedule) could delay other, existing submarine construction programs. However, the first MX missiles deployed on small submarines would be highly survivable, in contrast to other basing modes which would attain survivability only after most or all of the force was operational.

10. Surface Ship Mobile

Another approach to seeking survival by mobility at sea is to base the MX missiles on a fleet of surface ships. Such a fleet would be designed to have an appearance similar to merchant shipping, and to hide itself either in broad expanses of the ocean or among the other ships in crowded shipping lanes. The techniques for lowering missiles over the side of a ship and launching them from the water are well-established, although other launching modes might prove preferable.

Most of the points noted in the previous section about shifting the weight of U.S. strategic forces from land to sea apply. Unlike submarines, the surface ships would have a security problem in making certain that third parties did not attempt to seize the MX missiles. The ships would have to have a considerable capability for self-defense. The need for defensive weaponry could make it more difficult to disguise the ships.

An examination of the way in which such a force of surface ships might operate reveals numerous operational problems, which interact with the task of assuring survivability. Briefly, the Soviets could destroy any MX-carrying surface ship which they could locate or, having located, trail. OTA's analysis assumes that by the 1990's the Soviets would deploy a large force whose purpose was to locate and trail such ships, and finds that in such a case the proportion of a fleet of such ships which would be located and under trail might fluctuate greatly from day to day (this analysis is presented in the body of the report). Hence, although attacking such ships would be a formidable task for the Soviets, the United States could not have confidence in the survivability of surface-ship mobile MX.

While cost and schedule estimates cannot be precise for a system that has never been designed in detail, it is estimated that surface-ship acquisition costs would be only comparable to that of a fleet of small submarines. Annual operating costs would be slightly higher than that of small submarines. These differences are within the range of expected error. A surface ship fleet might be operational a year or two before a submarine fleet. Given the greater survivability of submarine basing, it would seem to be preferable to surface ship basing if sea mobile basing is chosen.

11. Air Mobile

Air mobile MX would be a system of great operational complexity, and therefore there is a corresponding wide choice of specific concepts. The lowest cost concept would consist of 75 or so wide-bodied aircraft, each carrying two MX missiles, maintained on strip alert at airfields located in the Central United States.

Such a "dash-on-warning" air mobile force could be highly survivable. The principal threat to the force would be submarine-launched ballistic missiles (SLBMs) launched from positions near U.S. coasts. Such an attack could arrive in the vicinity of the alert airfields within 15 minutes of launch and seek to destroy the aircraft before they could takeoff and escape. However, if a high-alert posture were accepted for the force, meaning that the aircraft took off *immediately upon timely warning* of SLBM attack, almost the whole force would survive even if a large number of SLBMs was launched from positions near U.S. coasts. The Soviet SLBM force is presently incapable of such an attack. Air-mobile basing could therefore stress Soviet strategic forces where they would be least able to respond in the short term.

Nevertheless, the difference between survival and destruction of the force would be a very few minutes, depending on timely tactical warning. In this respect an air mobile ICBM force would replicate a significant failure mode of another leg of the strategic Triad—the bomber force.

ICBMs, arriving later than the SLBMs, could not threaten the survivability of the force as a whole, since by that time the aircraft would have been in flight long enough to be dispersed over a wide area. Effective barrage attack of this area would require the Soviets to build many more large ICBM *missiles* than they now possess and use them to barrage a million or so square miles. The outcome of such an attack would be insensitive to both the fractionation (the apportioning of the missile payload among a small number of large-yield RVs or a larger number of smaller yield RVs) and to the accuracy of Soviet ICBM forces.

The principal disadvantage of a dash-on-warning force—the need for reliable, timely warning—could in principle be removed by having the aircraft maintain continuous airborne patrol.

However, even with a new aircraft designed for low fuel consumption, the cost of operating such a force would be prohibitive. A continuously airborne force of 75 aircraft (150 MX missiles) could cost $80 billion to $100 billion (fiscal year 1980 dollars) to acquire and to operate for 10 years after full deployment (FOC).

A second crucial problem for an air mobile force concerns the question of postattack endurance. After a few hours of flight, the aircraft would have to land and refuel. Since their home airfields would be destroyed, they would have to find other places to land and await further instructions. This problem could be avoided completely if the United States were willing to adopt a policy of "use it or lose it" for the few hours of unrefueled flight. There are also several hundred civilian and military airfields in the United States capable of servicing large aircraft. Many of these airfields are located close to urban areas. If the Soviets wished to *deny* postattack endurance to an air mobile fleet—tantamount to forcing the United States to "use it or lose it"—they would have to attack these airfields. A serious effort to build more austere recovery airstrips throughout the country than the Soviets possessed ICBM RVs to destroy them would be enormously expensive, would have substantial environmental impact, and would be completely impractical if the Soviet threat grew large. For instance, 4,600 airfields spaced 25 miles apart would fill the entire 3 million square miles of the continental United States.

There could conceivably be some value in having more airfields suitable for air mobile operations than the Soviets had *SLBM* RVs. These could be useful if the United States doubted the reliability of its SLBM warning sensors and wished to relax the force's alert posture (since, in a crisis, false-alarm takeoff might be mistaken by the Soviets for preparation to launch the MX missiles), or if the fleet were somehow "spoofed" into taking off (thus making a portion vulnerable as the aircraft were forced to land). A force with this dispersal option could cost $10 billion to $20 billion (fiscal year 1980 dollars) more than a wide-bodied jet force with no recovery airfields beyond existing large civilian and military airfields.

Thus, the lowest cost air mobile system would exclude extra recovery airfields beyond those large civilian and military airfields which exist at present. Although OTA has not performed detailed cost and schedule analysis for such an air mobile option, it appears that the cost of a force with 75 aircraft (150 MX missiles) on alert would be comparable to the cost of the baseline MPS system and could be deployed in a comparable time.

An air mobile force would also require several supporting systems. First and foremost would be reliable sensor systems for timely warning of Soviet attack. Providing such systems would be technically feasible but would require time, money, and continued effort. The complex force management needs of the air mobile force after attack would require a comparably complex communications system. Last, providing for missile accuracy comparable to land basing would require use of the Global Positioning Satellite system or a Ground Beacon System.

Comparison of Basing Modes

As we have indicated above, OTA's technical analysis of MX basing modes does not support a clear or simple choice. All of the basing modes reviewed have strengths and weaknesses. This section presents the criteria OTA has identified for the purpose of analysis, and uses them to compare the five most feasible options. Since no basing mode ranks high against all criteria, choosing among them depends on the relative weight attached to each.

Technical Risk

Technical risk refers to the level of confidence that one can have *at this time* that the system will perform the way it is supposed to.

There are significant risks associated with two of the five basing modes considered. PLU will represent an area of significant technical risk for MPS basing until prototypes have been tested, and could be a subject of lingering doubts even afterwards. The use of LoADS with MPS would compound this risk. An additional technical risk for LoADS concerns the requirement that LoADS operate in a nuclear environment of unprecedented severity, including high-yield nuclear donations roughly a mile away.

The risks of LUA arise not from technically difficult problems, but from the uncertainties of the interface between men and machines.

Survivability

A force is "survivable" if its destruction by a Soviet first strike is infeasible. Some basing modes aim at protecting the entire force while others accept some attrition and size the system to assure an adequate number of survivors. Survivability would be of critical importance to deterrence in either of two scenarios. The first is that the Soviets considered an all-out war inevitable, and were considering whether striking first would limit the damage such a war would cause to the Soviet Union. The second is that the Soviets sought to control the outcome of a crisis by partially disarming the United States while deterring the United States from responding. In either case, it would be important that the United States could feel confident that the Soviets would doubt their ability to destroy a relatively large proportion of U.S. strategic foces. All the MX basing modes are designed to provide this assurance, but they do so in different ways. For this reason, they create somewhat different risks.

A timely decision to launch under attack would prevent the Soviets from destroying the missiles before they were used. Air mobile MX would become vulnerable if the United States failed to receive and act on adequate warning, a failure mode which it would share with the bomber leg of the Triad. The MPS systems (including the MPS/LoADS combination) would become vulnerable if PLU broke down, and would also become vulnerable whenever the size of the MPS system was too small relative to the Soviet threat. This latter occurrence is not so much a question of technology as it is a question of the judgment and optimism of U.S. policymakers: a rapid growth in the Soviet threat could make MPS vulnerable unless the United States had decided to expand the system *before* Soviet intentions had become clear. Small submarines do not appear to be vulnerable, either now or in the foreseeable future. However, if an unforeseen Soviet breakthrough in antisubmarine warfare occurred, it is possible that it would threaten both small submarines and the Trident/Poseidon leg of the Triad.

LUA would become progressively less vulnerable as improved warning and communications systems were brought online. MPS (with or without LoADS) would become survivable only after the number of shelters deployed surpassed the number of Soviet RVs available to attack them. Small submarines would be highly survivable when first deployed.

Endurance

Endurance is defined as the capability to survive as an integrated system—both missiles and the communications needed to use them—for an extended period after a nuclear attack, *assuming* that the system survives the attack itself. An LUA system would clearly have no endurance.

An air mobile system would not endure longer than 5 to 8 hours unless the Soviets chose not to attack the airfields at which the MX-carrying aircraft could land and refuel. LoADS could be ineffective against a second attack. Small submarines with diesel-electric propulsion would endure from 1 to 4 months at sea, and longer if provisions were made for replenishment. Nuclear-electric propulsion could provide longer endurance for small submarines. MX/MPS is designed to endure in a low-power mode for many months after an attack.

Weapon Effectiveness

This criterion addresses the question of how well MX in the various basing modes could support those aspects of U.S. nuclear weapons employment policy which have previously been the specialty of the ICBM leg of the Triad, including ability to destroy hardened Soviet targets (accuracy and time-on-target control), strike rapidly on command (responsiveness), and support a doctrine of flexible response (retargeting capability).

Land-based systems (MPS, MPS with LoADS, and LUA) will continue to set the standard for accuracy, time-on-target control, responsiveness, and rapid retargeting. MX based on small submarines would be almost as good, and indeed would most probably be close to or equal the design requirements for MX. There would be few if any military missions of importance for which a submarine-based MX (given feasible upgrades in guidance systems, navigational aids, and C^3 systems) would be significantly less capable than land-based MX. Air mobile basing would sacrifice a degree of responsiveness because of the need for the aircraft to takeoff before launching the missiles, would require external navigation aids to achieve high accuracy, and management of a dispersed air mobile force could be very complex.

Command, Control, and Communications (C^3)

Reliable communications impervious to Soviet attempts at disruption are needed for commanders to assess the status of the MX force, retarget the missiles if desired, and transmit launch commands. The technical means to accomplish these tasks, as well as the tasks themselves, could be very different in the preattack, transattack, and postattack periods.

There are distinct and important differences from basing mode to basing mode regarding both the technical means to support effective C^3 and potential vulnerabilities. In each case, it appears that with adequate funding and effort, acceptable technical solutions are available, though it would be extremely difficult to secure any C^3 system against any and all contingencies. On balance, OTA has found no clear technical reason for preference among the basing modes on the basis of C^3.

Arms Control Considerations

The choice of basing mode could affect arms control in several ways. First there is the question of whether a given basing mode conflicts with U.S. obligations under a treaty now in force. Also of interest are possible conflicts with treaties signed but not ratified. Apart from specific treaty provisions, the United States has a longstanding policy that strategic systems should be amenable to verification. The impacts of MX basing on future arms control negotiation are speculative. They involve not only the negotiability of future arms control agreements, but also incentives which might be created for increasing or reducing the level of strategic armaments.

Deployment of a LoADS ABM system in defense of MPS would require amendment of, or U.S. withdrawal from, the ABM Treaty reached at SALT I, though much predeployment work could be done within the terms of the Treaty. In general, the five basing modes we are comparing appear compatible with the provisions of SALT II. MX/MPS has been designed specifically to be compatible with this proposed Treaty.

A future arms control agreement that permitted MPS basing but limited the number of missiles could be verified if the system permitting the deployment of the MX missile on small submarines or aircraft could be verified using established procedures and national technical means.

MPS basing could complicate future arms control negotiations. Detailed understandings about deployment procedures and peacetime operations, not previously included in arms control agreements, could be required for the United States to verify limits on a Soviet MPS deployment. Because MPS deployments must be large in order to be survivable, MPS basing could tend to provide incentives for continuing increases in numbers of strategic arms, and complicate efforts to seek agreements limiting or reducing these numbers. Moreover, MPS would necessarily focus attention on numbers of RVs.

Institutional Constraints

The Navy has shown little interest in small submarine basing of MX, and the Air Force opposes them. The LoADS ABM concept would not challenge existing roles and missions, but it would require early and close Army/Air Force cooperation. MX/MPS would strain the ability of Federal, State, and local jurisdictions to plan and coordinate adequate provision of social services and environmental protection.

Impacts on the Physical Environment

MPS systems would have considerably greater physical impacts than the other basing modes considered. In the Great Basin of Nevada and Utah these impacts would be particularly severe and could include the long-term loss of thousands of square miles of productive rangelands. Although the qualitative impacts of both split basing and Minuteman MPS would be essentially the same, the magnitude of these impacts would be significantly reduced by split basing and could be reduced further by basing in the northern Minuteman fields. Impacts of air mobile basing would result from airfield construction, but severe impacts would be unlikely. The impacts of submarine basing would be site-specific and confined to the areas where operating bases would be built, but could be significant within these areas. The impacts of LUA as a basing mode would be minimal.

Socioeconomic Impacts

The magnitude of MPS construction would have major impacts on the socioeconomic structure of any deployment area selected on the basis of minimum population criteria. Furthermore, uncertainties regarding the size and the distribution of the work force population would make advance planning so difficult that effective mitigation of adverse impacts would be unlikely. These impacts would be most severe in the case of MPS in Nevada and Utah, but would also accompany split basing or rebasing of Minuteman III.

The impacts of air mobile and submarine basing would be confined to the areas where operating bases were built, and might be positive or negative depending on the characteristics of the areas chosen. LUA would have no impact.

Costs

OTA has compared costs on the basis of "lifecycle" cost, which includes both the cost of acquiring the system and the cost of operating it until 2000.

The baseline MX/MPS system of 200 missiles and 4,600 shelters was sized to provide adequate survivability against a particular Soviet threat. For costing purposes OTA has sized the other systems to provide equivalent survivability against a comparable threat. If the Soviet threat should grow, MPS systems (including MX defended by LoADS and Minuteman/MPS) would have to grow accordingly. Submarine basing, air mobile basing, and reliance on LUA would not.

The following table summarizes OTA cost estimates for the basing systems. The lifecycle costs of baseline MPS (4,600 shelters with 200 missiles), small submarines, and air mobile are all about $40 billion (fiscal year 1980 dollars). OTA estimates that split basing would cost about 7 percent more. Rebasing Minuteman III would be about $7 billion less expensive than the baseline MX/MPS systems. LUA would be considerably less expensive than the others, even after very substantial upgrading of warning and communications systems.

Against an increased Soviet threat, the cost of MPS would grow. If the Soviets devoted substantial effort to threaten MPS, and if the U.S. response was to increase the number of shelters and missiles, then the lifecycle cost to the year 2000 of $43 billion for the baseline system (OTA estimate in fiscal year 1980 dollars) might have to grow to $58 billion to $62 billion by 1990 and to $78 billion to $83 billion by 1995. Adding LoADS instead of increasing the number of shelters could cut costs: a Congressional Budget Office study estimates that using an optimal mix of LoADS, addi-

Summary, Lifecycle Cost Estimates for Basing Options
(billions of fiscal year 1980 dollars)

	MX/MPS baseline	MX/MPS expanded 1990 threat	MX/MPS expanded 1995 threat	MX/MPS vertical shelters	MX/MPS split basing	Small submarine	MM III MPS	MM III expanded 1990 threat	MM III expanded 1995 threat
Number of shelters.	4,600	8,250	12,500	4,600	4,600	51*	5,800	10,400	15,500
IOC/FOC (calendar year)	87/89	87/89	87/94	87/89	87/89	89/95	87/90	87/91	87/94
Number of deployed missiles	200	359	544	200	200	204	667	900	1,100
Development.	$ 9.172	$ 9.372	$ 9.572	$ 9.172	$ 9.172	$ 7.225	$ 2.527	$ 2.500	$ 2.500
Investment	27.999	43.557	61.512	26.500	30.109	24.862	28.037	43.200	60.400
Total acquisition.	$37.171	$52.929	$71.084	$35.672	$39.281	$32.087	$30.564	$45.700	$62.900
Operating and support to year 2000	$ 6.308	$ 9.482	$11.486	$ 6.308	$ 6.526	$ 7.160	$ 5.907	$ 7.700	$ 9.500
Lifecycle cost to 2000 . .	$43.479	$62.411	$82.570	$41.980	$45.807	$39.247	$36.471	$53.400	$72.400

*Submarines.

SOURCE: Office of Technology Assessment.

tional shelters, and additional missiles would save about 10 percent against the 1990 threat and about 18 percent against the 1995 threat.

Note that efforts to make the survivability of air mobile independent of warning by means of airborne alert, or to give air mobile some endurance by building additional dispersal airfields, would drive its cost up very sharply.

Schedule

The advocates of each of these basing modes project initial operating capabilities in the mid- to late 1980's. These projections are based on rather optimistic assumptions, and the record of U.S. development of weapon systems in the recent past suggests that schedule slippages are likely.

In considering schedule it is necessary to distinguish among three dates for each possible basing mode.

1. Initial operating capability (IOC) refers to the data at which the first missiles would enter the active strategic force. This date is significant from the viewpoint of the overall strategic balance, and concern with how perceptions of this balance may affect U.S. diplomacy.
2. Full operating capability (FOC) refers to the date when the last missiles and basing facilities would become active.
3. Survivability refers to the date when the deployed system is judged to be adequately survivable against the then-existing Soviet threat. This date is significant from the viewpoint of reversing the effects of the growing Soviet capability to destroy the Minuteman force in a first strike.

Depending on the basing mode and the growth in the Soviet threat, survivability could coincide with IOC, could coincide with FOC, or could come at a date between them.

Because considerable engineering development has been accomplished for MX/MPS, it could probably achieve IOC in 1987. Minuteman MPS could not have an IOC before 1986, even though the missiles already exist, because of the need for an environmental impact statement, site selection, land acquisition, and the need to design a PLU system before starting construction. FOC dates for MPS systems would depend on the size of the Soviet threat. Reasonable FOC dates are 1989 or 1990 if 200 missiles and 4,600 shelters prove to be enough, and a Minuteman MPS of comparable size could be completed at about the same time. So long as the threat kept growing, the system could never be completed in the sense that construction could stop. However, survivability could be achieved before Soviet threat growth and U.S. construction stopped. For example, a 1990 threat of 7,000 Soviet RVs could be met by an MX/MPS system of some 8,250 shelters and 360 missiles. These could be completed by 1990 *provided* that a firm decision to build at that rate were made in late 1982 or early 1983—before firm evidence of Soviet building plans is likely to be available. To retain survivability after 1990 would require a building program that kept pace with any continuing growth in the Soviet threat.

LUA could begin, in principle, as soon as MX missiles could be deployed, but upgraded warning and communication systems might not be deployed until the end of the decade.

Adding LoADS to MPS would probably not affect FOC significantly. Submarine-based MX IOC could be as early as 1988, but 1990 seems more likely. An FOC for submarines appears achievable as early as 1992, but OTA believes that 1994 would be more realistic. However, since submarine basing would achieve survivability at the IOC date rather than the FOC date, submarine basing might well achieve survivability sooner than any of the other basing modes despite the fact that its IOC could well be the latest.

While OTA has not performed schedule analyses for air mobile, it appears that an air mobile system might also be deployed by the end of the decade.

Stability

MX basing could affect stability in three different senses. In the first, survivability (which is treated separately above) enhances stability by avoiding a situation in which the Soviets might start a war because they expected to obtain an advantage by destroying vulnerable U.S. forces. Second, MX basing should, if possible, minimize the risks that a war might start because of accident or miscalculation during a crisis. Finally, MX basing could affect the incentives which shape future nuclear weapon deployment decisions: termed arms race stability.

MPS basing introduces the prospects of an increasing number of U.S. shelters and missiles in response to an increasing number of Soviet RVs. From the U.S. point of view, keeping pace with a

BEST COPY AVAILABLE

growing Soviet threat could be costly and would put a premium on determining and projecting the number of Soviet RVs. For their part, the Soviets would be tempted to expand their RV inventory, taking advantage of their existing throwweight to overwhelm the U.S. MPS deployment. On the other hand, the Soviets would be concerned about the effects of a growing MX deployment on the survivability of their own ICBMs.

LoADS ABM deployment could permit an MPS deployment to attain survivability against a given threat level with a smaller number of MX missiles; in this sense it would contribute to arms race stability. On the other hand, it could reopen the qualitative arms race in ABM technologies and offensive penetration techniques (including larger numbers of offensive weapons) which the 1972 ABM Limitation Treaty sought to foreclose.

Small submarine basing would be survivable and might force the Soviets to redirect their efforts from building offensive weapons to intensify antisubmarine warfare research. Since strategic antisubmarine warfare appears very unpromising, this would be stabilizing. However, if the Soviets did achieve an antisubmarine warfare "breakthrough," it would be highly destabilizing.

LUA poses the risk of failure during peacetime or during crisis which could lead to accidental war. U.S. deployment of a new missile in a nonsurvivable basing mode could also create a Soviet perception that in a crisis the United States might choose to strike first rather than wait to launch under attack.

Air mobile would be survivable and would therefore not create incentives for the Soviets to expand their ICBM force. However, its dependence on timely warning could create tension in a crisis.

NOTE: Copies of the full report "MX Missile Basing" can be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

BASING OF MX MISSILE

Dr. **Gibbons.** When the Board requested this analysis, it directed us specifically to study the question of how the MX missile might be based, specifically avoiding such larger issues as why and whether the missile is needed.

During the latter course of the study the Board asked us to look at the possibility of rebasing existing Minuteman III missiles in a multiple protective shelter, MPS, mode, by constructing additional vertical shelters in the existing Minuteman fields. We reviewed all the basing modes we are able to identify and we conducted detailed analysis of 11 of those alternatives.

We found that there are five basing modes which offer reasonable prospects for feasibility and survivability. I should emphasize, however, that none of the five modes is without serious problems, risks, uncertainties, or drawbacks. As a matter of particular interest, and one of the major findings of the study, we found no basing mode which would be likely to provide a substantial number of survivable MX missiles much before the end of this decade.

The so-called "window of vulnerability" simply cannot be closed quickly.

SURVIVABILITY OF FIVE SELECTED BASING MODES

Five basing modes which are probably feasible and which offer reasonable prospects of survivability in the 1990's are as follows:

No. 1: Multiple Protective Shelter Basing Mode.—There are several variants of this, including MPS for Minuteman, which offer similar prospects and similar drawbacks.

No. 2: MPS basing defended by a low-altitude ABM system known as LoADS.

No. 3: Basing MX in silos and relying upon launch under attack to insure that the missiles can be fired before the Soviets could destroy them.

No. 4: Basing MX on relatively small submarines.

No. 5: Air-mobile basing in which the missiles would be dropped from wide-bodied aircraft and launched while falling.

UNACCEPTABLE BASING MODES

Among the other basing modes which, on the basis of our analysis, we do not consider possible choices for this time frame, are two which are of particular interest: (1) basing MX in silos and relying on an ABM system to defend them. In this case missiles and silos might well face eight or more attacking Soviet warheads for each silo over the next decade or two, and we don't believe that sufficiently reliable technology can be in hand to defend against attacks of this intensity; (2) the second of the basing modes which is of particular interest but not a reasonable choice at this point is basing MX on surface ships, which is technically feasible but would offer substantially less survivability than submarine basing.

Before Peter Sharfman reviews the principal findings about each of these possible basing modes, I would like to present a brief overview of the bottom line for each of the five.

MPS MODE

First, the MPS mode.

The principal advantages of MPS are that this mode would tend to preserve the existing structure and balance of U.S. strategic forces. It would offer greater mission capability than the existing ICBM's and it would restore in time the survivability of our land-based component of the triad.

The principal disadvantage of this option is that MPS would require the United States to incur very high costs both in terms of dollars and regional impact.

I think you heard on Tuesday from the DIA that the Soviets are capable of deploying a very large number of reentry vehicles, RV's, by the early 1990's. You also heard from General Burke that in his personal opinion the Soviets would not do so.

The problem, as we see it at OTA, is that if the Soviets do, in fact, deploy very large numbers of warheads by 1990, 4,600 shelters would simply not be enough. To cope with this threat, the United States would have to commit itself by early 1983 at the latest to an accelerated construction schedule in order to attain survivability against the projected Soviet threat at the end of 1990.

In 1983 we will not know what the 1990 threat will be. We will only know what it could be. OTA finds that a prudent construction schedule, and this is based on a somewhat smaller Soviet threat than the one DIA briefed you on, would aim at somewhere between 8,000 and 9,000 shelters and 350 MX missiles deployed by 1990. This would cost more than $50 billion in 1980 dollars over the next 9 years and there would be comparable costs in the following decade, that is, the decade of the 1990's, if the Soviet threat continued to grow.

Such a system would also have severe impacts on the region of deployment, with some possibility that thousands of square miles of rangeland could become permanently unproductive. Moreover, the system would offer survivability only if we succeed at what the Air Force calls the "preservation of location uncertainty."

Senator LAXALT. I gather you don't accept the premise of the Air Force that we could maintain security adequately by just simply fencing off the individual shelters?

IMPACT OF CONSTRUCTION ON AREA

Mr. SHARFMAN. That is not the whole story. The point is that you would have to build roads in a grid pattern. That means that while a section of road might occupy a few square yards, there would be a large area of land close to that road. Because of the grid pattern, you would have virtually the entire valley close to one road or another and, therefore, impacted by the effects of the construction. You would be taking a small amount of land but you would have an impact on a large amount of land.

Senator LAXALT. You draw a distinction between the taking for the purpose of a roadway and later use. Is there a possible connection with there being mulitiple use of the area with roadways?

Mr. SHARFMAN. There might be problems.

Senator LAXALT. On security grounds?

Mr. **Gibbons**. That is right. That is an area where we don't believe there can be real certainty until after there has been prototype testing of the missiles and decoys and the Air Force has a clearer idea of what the most effective thing the Soviets could do to find the missiles would be and, therefore, what is necessary to guard against them.

Mr. **Sharfman**. We are a little skeptical that you could really have no restrictions whatsoever. If a mining company came in with all kinds of complicated electronics equipment to prospect, we think that the Air Force would at least want to know whether the real owners of that mining company were in East Germany or some other country. To know that, the Air Force would have to establish some sort of legal basis for finding out, and perhaps a further legal basis to do something about it.

But, really, 1981 is too early to know what is necessary and, therefore, what is to be done.

LIMITATIONS AND IMPACT ON AREA ECOLOGY

There are two kinds of impact. There is limitation on multiple use that comes from worrying about security and the limitation on agricultural use that comes from the fact that this is a dry area to begin with, a fragile ecology, and the impact of the construction can do a lot of damage to the existing vegetation. It would be difficult and expensive at best to revegetate the area that had been impacted by the construction so that it could be used as productive rangeland again in the future.

The degree of adverse impact would depend on whether there is a lot of rain in the years immediately following construction, which is something we can't tell.

Senator **Laxalt**. We are short of that out there.

Senator **Garn**. We have not seen much in the last 100 years.

Mr. **Sharfman**. There are some variations from year to year.

Senator **Garn**. Some years they get an inch and a half, two inches, of rain a year. Other years they get a half inch.

Mr. **Gibbons**. The bottom line is that it is difficult to have high confidence in PLU and therefore area restrictions until some systems have been constructed and tested.

MPS WITH LOAD SYSTEM

The second mode of the five whose bottom lines I wish to summarize for you is the MPS with LoADS. If one adds the LoADS ABM system, this would make a given number of shelters viable against a larger Soviet threat. Unfortunately, it would also increase substantially the technical risks associated with PLU; and the consequences of a failure of PLU, of course, would be catastrophic.

It is hard enough to make a missile and a decoy match. To make a missile, a decoy and a LoADS defense unit all match would be much more difficult. In addition, the LoADS defense unit would have to operate in a very severe nuclear environment that would further constrain its design. Adding LoADS would also require amending or withdrawing from the ABM treaty, and it might mean that we would have to cope with a Soviet ABM system in response to this.

LAUNCH UNDER ATTACK

The third basing mode is launch under attack. Like the MPS mode, this option would preserve the familiar features of U.S. strategic forces. It would be possible with extensive investment in better warning and communications systems to make such a system technically reliable, even in the face of Soviet efforts to disrupt it, and it would be by far the cheapest way to base MX. However, it would require National Command Authorities to be instantly available at all times and willing to make an effectively irreversible decision in a matter of very few minutes on the basis of information obtained from remote sensing.

Senator **Laxalt**. What are we talking about in terms of lead time, a half hour?

Mr. **Gibbons**. A fraction of that.

Peter, do you want to summarize that?

Mr. **Sharfman**. [Deleted] that gets the word from those sensors to the President. The technology is there if we want to buy the equipment.

Now at the other end of the time line there is a certain amount of time that is necessary after the President issues an order to get that word to the missiles and, in effect, press the button and turn the keys and have them launched. That could not be cut, really, below 5 minutes or so. Again, that is assuming some improvements over what we have today. All told, the President, given this additional investment, might have about 15 minutes between receiving the reliable word that the Soviets have launched and the last possible minute to order a U.S. launching.

Senator **Laxalt**. Is there any problem with our additional technology that the word we would receive would, in fact, be reliable?

Mr. **Sharfman**. Well, machines and men work in different ways. You get unexpected errors when men rely on what machines tell them, and machines do what men tell them to.

There is no reason at all why the machinery could not be built to work perfectly. You could not run a fullscale operational test.

Mr. **Gibbons**. You would almost have to preprogram the decision.

Mr. **Sharfman**. There is a further problem, that the Soviets could attack with [deleted] although [deleted.]

MASSIVE ATTACK LAUNCH

Senator **Garn**. First, I recognize the problems of the existing systems, but the question I asked the other day, and that I continue to ask, is that we are not talking about a launch of a few missiles; you are going to have a massive attack. I understand what you are saying about man and machines and so on.

I cannot believe that our equipment is so poor that if you got several thousand coming—and they are going to have to launch several thousand warheads, a massive number—I don't know how you can mistake that for anything except a first strike.

If a first strike comes, it has to be massive, absolutely massive, or there is no point in doing it. They want to get rid of 90 percent of that Minuteman force.

SUBMARINE MISSILE LAUNCH

Sure, they can launch from submarines; that is not a hard target. [Deleted.]

So you are talking about two different things there. You need to separate that.

Mr. **Sharfman**. I would like to respond briefly, and then ask Ash Carter to respond.

The idea would be that submarines would be attacking Washington, D.C., or wherever they thought the President was, in an effort to prevent a launch order from getting out. The submarine missiles [deleted]. This then raises the very thorny political issue of making advance arrangements for what to do with the missile force. I mean, assuming that the general in command of the missile force suddenly can't reach the President.

MISSILE TARGETS

The other point that I think is pertinent on the time line is that sometime during that 15 minutes information would begin to become available about the targets of the Soviet missiles. We certainly would not get information about where in the United States they were aimed at the moment they were launched, and that could be pertinent in terms of the President's chosing among the response options.

If I may, I would like to ask Dr. Carter to elaborate.

Senator **Garn**. I understand, but I cannot imagine they would not try to eliminate that second-strike threat to them, our first strike. If I were a Soviet planner, I would certainly want to get rid of our most potent threat, which is the Minuteman force at this time; I cannot imagine any other logic.

Mr. **Sharfman**. There would be the question of whether they would also at the same time be attacking other targets. That is something that the President might want to know in deciding how to shape our retaliatory strike.

SUBMARINE WEAPON FORCE

Mr. **Carter**. In regard to the submarine weapons, I think the importance of them is not that they, themselves, would constitute a primarily counterforce threat to the silos, but that they might arrive sometime during the period of decisionmaking and thereby help the President make that decision, if detonations on the United States were confirmation for him that we were indeed under attack. So they have some importance there.

They also have some importance if the intention of the Soviet precursor attack is to destroy the command authorities, to destroy Washington.

With regard to the high reliability of the warning sensors, the probability that a given warning sensor falsely indicates that something is wrong might be quite high. That it falsely indicates something like a plausible Russian attack is somewhat less probable; and the probability that several warning sensors of different types all falsely indicate something which looks like a Soviet attack, is more remote still.

From the point of view of electronics and machinery, the probability is exceedingly small or arbitrarily small. Where you get into trouble is when you get a man and the machine together and, for instance, run a test tape. The machines themselves, I think, you can secure against these accidental warnings.

SCENARIOS ON FIRST STRIKE

Senator **Garn**. I understand the scenario, but you are all talking like attorneys of every conceivable scenario that you can come up. Give me a baseline answer. Isn't it a tremendous deterrent to the Soviet Union if they think they are going to hit empty silos? Sure, you can plot out all these possible scenarios. Isn't it something worth pursuing, upgrading the equipment and have a national policy telling the Soviet Union, "Look, we see them coming whenever they are coming, wherever they are directed then you are going to have them going the other way; they are going to pass and wave as they go by"?

Mr. **Sharfman**. It is our understanding that it is now a national policy——

Senator **Garn**. They have no policy.

Mr. **Sharfman**. It is a national policy to have no policy about what we would do, but to maintain a capability to launch under attack if the President chooses to do that, and be rather cheerful about the Russians realizing we have such a capability. There is a lot of room for upgrading of that capability as it exists today.

Presumably, an upgrading of that capability would increase the Russians' sense that this might happen to them.

Senator **Garn**. That is the point I am trying to make. All these scenarios—[deleted] kill the President, and all of that—do not make some sense because from my looking at the background of this, we were supposed to have a much better system right now than we have had. It has not worked the way it was expected to work, with some of the failures and uncertainties. We have spent a lot of money for a system that has not provided for what it was intended to at this point. Isn't that correct?

Mr. **Gibbons**. I believe that is correct. I guess that Peter's main point——

Senator **Garn**. Apart from all of this debate about MX, we have had another failure, a partial failure, in this area, which is something we ought to be upgrading in any event.

Mr. **Gibbons**. Advancing technology alone gives you opportunities to upgrade and maintain a very important option.

Senator **Laxalt**. May I ask the gentleman a question?

Is the Senator from Utah correct when he states we have no policy at the present time on launch under attack?

DEPARTMENT OF DEFENSE

DEPARTMENT OF THE AIR FORCE

STATEMENT OF LT. GEN. KELLY BURKE, USAF, DEPUTY CHIEF OF STAFF FOR RESEARCH, DEVELOPMENT AND ACQUISITION, HEADQUARTERS, U.S. AIR FORCE

SOVIET POLICY

General **BURKE**. That is my understanding, that their policy is not to have a policy, not announce that that is what we are going to do.

Senator **LAXALT**. What is the rationale for the policy?

General **BURKE**. It preserves, I think, one additional level of deterrent by holding out some prospect that you may do this, and at the same time it avoids the destabilizing situation of stating with certainty that we have our finger on the trigger and if you blink we are going to let go, which, in turn, will encourage the Soviets to get in the same posture.

Senator **LAXALT**. Do you accept the Senator's contention that our policy was that if we would do it, that that would add to our deterrent value?

General **BURKE**. It would, I think, add additional deterrent, but it would also, I think, add the destabilizing effect of a potentially dangerous condition.

Senator **LAXALT**. You are injecting the hair trigger element; is that what you are worried about?

General **BURKE**. It seems to me that if we had high-value systems that are vulnerable and they have high-value systems that are vulnerable, and we announce that we are going to pull the trigger, they are going to do the same thing. I think that is all right in normal conditions, but I think when things are very tense, there is a crisis underway, there is at least a remote chance through inadvertence, mistake miscalculation——

Senator **GARN**. Isn't it a case that during this whole period of détente we have always used that argument on our side—not to do anything because it is destabilizing—and we have not deterred the Soviets to follow suit or reciprocate in any way, they are doing it anyway?

General **BURKE**. Absolutely.

Senator **GARN**. Maybe I am an old bully, but I am tired of constantly backing down over and over and over again and seeing no change in their behavior. Why, it is one thing to speculate—we can all speculate about the future—but the record is clear over the last decade of our utter foolishness, in SALT I, the ABM Treaty and SALT II Treaty as negotiated, and it has not changed their design bureaus one bit. They have their own agenda.

I know I sound like a broken record, but it is a fact, they have their own agenda of what they want to accomplish in a certain period of time, and they do it regardless of what we do.

We sit back and say, "Oh, if we did this it is destabilizing." That record I read to you the other day, back in 1972 on the ABM Treaty, how if we did not deploy the ABM they would not build the defensive weapons, they would not have need to. They did not agree with Senator Fulbright. They went on with the 17, 18, and 19 and did not slow down one bit.

DESTABILIZATION POLICY

When I hear arguments again, particularly from a blue suiter with three stars, about destabilizing, why don't we destabilize them for a change? Why don't we start doing some things and let them know that we are serious about defending ourselves?

General **Burke**. I am making a somewhat different argument than you are outlining, or trying to. I agree virtually with everything you have said.

Senator **Garn**. You are saying they may put their finger on the trigger. I am saying they have had their finger on the trigger all along.

General **Burke**. I suspect not anywhere nearly as close as it would be under the circumstances we have outlined, particularly if we have MX in a silo and announced policy that our finger is on the trigger. I think that that has to force them to get a little closer to their trigger.

I have no brief for the notion that the Soviets are going to be motivated to do the desired thing from a unilateral example of good behavior on our part. I think that is naive and history will show that that is wrong. I have opposed that type of policy as long as I have been dealing with these issues.

In my mind, MX in a survivable basing mode certainly is the primary pressure on the Soviet Union because it puts at risk that portion of the force which they value.

Senator **Garn**. I am trying to find if warning would save money. I don't care if we triple our military force. If the Soviets don't think we are going to use it, it is worthless.

I will give a simplistic story and I know I am taking too much time. Maybe I am just a simple old-fashioned boy from Utah, naive.

I remember once when I was in grade school there was a big bully that threatened me with the old pants pitch; you know, pull down your pants. I for several months walked three blocks out of my way because I knew he was always waiting for me on the most direct route home. Finally, I got tired of that and I decided, fine, I will take the consequences. I walked up; he was waiting for me. I said, "You take my pants down and I going to beat the hell out of you." He backed right off. I thought for months I have been afraid of that boy.

It is a very simplistic, naive story, I suppose, but I think the Soviets are a little bit like that big bully; they think we are rather naive and foolish.

I think that it is time that we have a President and an administration that lets them know that the last 10 years have been a failure of détente and it is time we start being tough, talking tough, and backing it up. We might be surprised. We might not destabilize them; we might actually back them down somewhat.

General **Burke**. It is for those reasons I would like to see a highly capable system like MX put out there that could put at risk and threaten their ICBM's. I would be happier and sleep better at night if ours were not subject to vulnerability.

Senator **Laxalt**. Please continue. As the Senator from Alaska has time limitations, I guess we should expedite the presentation of OTA to make certain you have done your job well.

OFFICE OF TECHNOLOGY ASSESSMENT

STATEMENT OF JOHN H. GIBBONS—RESUMED

Mr. **Gibbons**. In that case, I will move on to the next option.

May I add just a word? It seems to me, Senator Garn, that the issue raised is an important one. Apart from what our stated policy is or might be, it is a very interesting point whether we have a clear capability for sensing with high discrimination a threat that may be coming, and an ability to react to that in time in a very credible way.

If we had such a capability, then even without stating a policy in advance on what we would do, we would demonstrate very clearly we have the option.

Senator **Garn**. I understand that. Can you answer one more technical question, then?

COST OF UPGRADING EQUIPMENT

In order to upgrade this equipment you simply said it was expensive. How expensive and what time frame compared to the MPS as envisioned by the Air Force?

Mr. **Carter**. We have not looked into the cost in detail, except to confirm that it would be billions, rather than tens of billions, of dollars. We don't have a firm number on that, nor really on the schedule.

As far as warning sensors are concerned, one could take measures which we do not have at present to secure our [deleted] which I won't discuss here. We could [deleted].

Another thing we could do is look to other kinds of sensors, [deleted] or [deleted].

We can look to rocket-launched probes of the kind used in the forward acquisition systems for ballistic missile defense; and we can look at land-based and ship-based radars of the kind that PAR is, look into a threshold defense for them, and so forth.

You can never really secure them against attack absolutely, but you can drive the price up a bit so that you are asking for quite a provocation before you allow it to be destroyed. In a similar way, we could drive up the price to attack communications, the rearward communications from the sensors to commanders and so forth. That is the kind of agenda we are talking about.

There is a wide variety of sensors and no one sensor can be made absolutely secure, but taken together, disruption of them could be made time-consuming, provocative, costly, and exceedingly difficult.

That is the kind of thing we have in mind in talking about launch under attack.

Again, as I have said about the cost and schedule, most of the cost itself presumably would be development costs, and we don't have anything specific to say about that, except that it is not $30 or $40 billion.

Mr. **Gibbons**. I will turn to the small submarine option, Mr. Chairman.

SMALL SUBMARINE OPTION

Basing MX on relatively small submarines could provide military effectiveness comparable to land basing, and there is every reason to expect that it would be the most survivable of the available basing options, especially under conditions of partial deployment.

Let me elaborate on these two points.

Some of the press misinterpreted our interim briefing that we gave over in the Capitol in March as an OTA endorsement of the small submarine option. MX missiles based on submarines could be optimized to emphasize the features which today are the specialty of land-based missiles—accuracy, responsiveness, time on target control, and rapid retargetting. They could be made better in these respects than the Minuteman missiles are today, but land-based MX might still be made even better.

It is not clear to us whether the marginal difference would have any military or strategic significance, however, but shifting the weight off U.S. strategic forces from land to sea, that is, abandoning the notion of giving equal importance to land, sea, and air basing for strategic forces, would have political impacts that go beyond purely technical questions such as missile accuracy.

SUBMARINE SURVIVABILITY

OTA studied the question of submarine survivability in considerable detail. We find no scientific or technological basis for projecting a significant Soviet threat to ballistic-missile submarines in the foreseeable future; however, we can't completely exclude the possibility of an unexpected technological development in submarine warfare.

Although MX-carrying missiles would differ from Trident in ways that would be critical for some kinds of antisubmarine warfare, the same unexpected breakthrough might threaten both systems.

The lack of appropriate shipyard capacity in the United States would probably delay initial deployment of MX-carrying submarines until about 1990. Of course, unlike MPS, the first MX missiles deployed in this way would be survivable.

Senator **Laxalt**. Are you talking about one missile per sub?

Mr. **Gibbons**. Four.

Senator **Laxalt**. We are talking about 50 subs?

Mr. **Gibbons**. That is right.

Mr. **Sharfman**. We cost it on the basis of 51.

Senator **Stevens**. Do we have any old subs, as we have old battleships?

Mr. **Sharfman**. We do have some old submarines, but given the need to make them quieter and more capable in the kind of environment we are going to be seeing as antisubmarine warfare techniques do improve, the modernization cost would be so high that we may as well go ahead and build new submarines.

Mr. **Gibbons**. The key point is the improved technology that is available.

SUPPORT OF SUM CONCEPT

Senator **Garn**. Clarify your remark about the mistake in March with respect to your report. What came out, that you supported the so-called SUM concept? You explained to me that is not correct. Your small submarine option was a new class of submarine, bigger than the so-called German sub they were talking about, but much smaller than Trident. I want you to clarify that, because you went over it quickly and you have never supported SUM.

You talked about the advantages and disadvantages of a small submarine, but a new submarine?

Mr. **Gibbons**. That is correct.

Senator **Stevens**. What is relative in terms of dollars as opposed to the MPS?

Mr. **Gibbons**. I will provide you with some numbers. The cost for the same threat of the MPS is $43 billion. The small submarine would be $39 billion. It is comparable.

Senator **Stevens**. The basic cost is time?

Mr. **Gibbons**. All systems would take time. Possibly the difference is that while the submarine might come on a couple of years later than the first deployment of MPS missiles, the survivability of even the first sub is very, very high and the survivability of only a partially deployed MPS is quite questionable.

Mr. **Sharfman**. Getting back to the two points that General Burke made a couple of minutes ago, there is the dimension of having MPS missiles on line threatening the Soviets, and there is the dimension of those missiles being survivable so that we don't have to worry as much as about the Soviet threat to us. On the first, having the missile on line, the submarines would take longer than some of the other options because the shipyard capacity that can build submarines is so backed up, and it takes a long time for a shipyard that doesn't build submarines to learn how to do it right.

On the second dimension of having missiles that are survivable, the submarines would do about as well as any of the others because the first submarine would be survivable while the land-based MPS requires quite a large deployment before survivability is obtained.

PLACING OF MX AT SEA

Senator **Garn**. Let me ask you this question. Why could you not consider putting MX at sea in any event in any form rather than the Trident II which is already being worked on?

Mr. **Sharfman**. That explicit comparison is outside the terms of reference of our study. We did not look at the capability or the scheduling of the Trident II missile.

Senator Garn. It really seems duplicative if you are going to consider going to sea and abandoning the Triad. From all I can learn the Trident II is going to have a hard target kill capability.

Mr. Sharfman. That is certainly the case. The advantages would be two in number and they might not outweigh the cost. The first would be that it would provide some degree of hedge against future Soviet development in antisubmarine warfare because this hypothetical MX-carrying submarine is quite a different boat from the Trident. It is smaller, it is slower, it operates close to home and there are a lot of them out there at once.

TRIDENT SYSTEM

The Trident is fast and big and with the Trident II missile could be virtually anywhere in the world but there would only be a few of them at sea and the Soviets would concentrate a lot of resources. From the point of view of making Soviet antisubmarine warfare planning difficult, the diversity would make their lives very difficult. The other point is that there is a backlog on submarine construction. The Trident program is behind schedule. If we were building two quite different classes of submarines, we might have a better chance of getting a lot of missiles actually under the water operational and threatening the Soviets at least in the early 1990's as compared to having to build a larger number of Trident boats one after another in the shipyard.

Senator Garn. The point you are emphasizing here is the lack of capability of our shipyards to produce submarines at all from the quantity standpoint and from the quality standpoint. It is a major problem as evidenced by the 2-year delay with the first boat leaving Groton yesterday.

IMPACT OF SALT ON MISSILE SYSTEM DEPLOYMENT

Senator Stevens. Let me ask this question. I think you have done a very credible job. In your scenario here what is the impact of SALT or no SALT on these options of MPS submarine deployment and silo deployment? Let us assume in the first place that we decide that we are going to go SALT. Is the submarine deployment compatible with SALT?

Mr. Sharfman. Submarine deployment would be compatible with SALT II and there are no obvious problems about the submarines from the point of being compatible with some hypothetical SALT III.

Senator Stevens. How about the silos?

Mr. Sharfman. Deployment in undefended existing silos would be completely compatible with SALT. Defended silos would require amending or withdrawing from the ABM Treaty which would limit us to an ineffective defense.

Senator Stevens. Even with the LoADS?

Mr. Sharfman. The treaty as it stands limits us to a 100 ABM units. A hundred ABM units attacked by a thousand Soviet RV's would simply be saturated, no matter how good the ABM was technically or where it was. For an ABM to have much of a chance you would have to get above that number of a hundred and that means getting out of the treaty or amending the treaty.

Senator STEVENS. We are talking about either MPS or submarines.

Mr. SHARFMAN. SALT II would forbid construction of new silos but it would permit us to modernize existing silos. There is no particular problem about fitting MX into existing silos suitably modernized.

Senator STEVENS. Thank you very much.

Mr. GIBBONS. Mr. Chairman, I might skip a brief discussion on air mobile and ABM defense of silo basing.

Senator LAXALT. Cover the high points.

AIR MOBILE AND ABM DEFENSE OF SILO BASING

Mr. GIBBONS. Air mobile has some of the same problems that we have with our bomber leg of the Triad in terms of potential failure mode. Of course it is very survivable in response to a first strike but once committed to the air in the face of a strike, these planes could not get back to base in all likelihood and would have to be used or lost in a period of hours. In the case of ABM defending silo basing, a low altitude defense such as LoADS offers reasonable confidence of destroying the first RV aimed at the missile site that it is defending. That would force the enemy to target at least two warheads at each site. The ABM defense might be able to shoot down a second RV in spite of the tendency of the nuclear fireball from the first to interfere with acquisition tracking and destruction of the second RV.

There is virtually no chance of low altitude intercept of several sequential Soviet RV's. If each Soviet salvo must attack 4,600 or more MPS shelters, forcing the Soviets to attack each shelter at least twice, this would impose a major cost on the Soviets. However, if they are attacking only 200 silos or even as many as 1,000 silos, they could readily afford to attack each MX missile 6 or 8 times and therefore overwhelm any LoADS type ABM.

EXO-ATMOSPHERIC DEFENSE

The response to this problem in theory is exo-atmospheric defense, or better, so-called layered ABM defense combining exo-atmospheric intercept with low altitude to catch the few Soviet RV's that leak through an effective exo-atmospheric defense. The Army has developed this so-called overlay concept in which infrared-sending interceptors would be launched outside the atmosphere to detect and destroy Soviet RV's in space.

Unfortunately overlay is still in the technology exploration stage, and major technical issues, which include both the underlying technology and the robustness of the total system in the face of Soviet countermeasures that are quite plausible, will not be resolved for some time. In addition, we feel that there is a potential Achilles heel in the susceptibility of IR sensors to be fooled by decoys in the exo-atmosphere.

ORBITING LASERS

Another approach to defense of silos would be to orbit lasers or other directed energy weapons which could destroy a Soviet missile during its boost phase before the decoys are deployed. Here too the necessary technology is an indeterminate number of years in the future and therefore we feel not an option that one can depend on today. Consequently we feel that it would be imprudent to decide now at least to rely on ABM to defend MX in silos in the 1980's or perhaps even the 1990's.

Let me then conclude with a few words on cost.

DEFENSE OF EXISTING SILOS WITH ABM IMPRUDENT

Senator LAXALT. Before you hop away from that, it would be imprudent for us to defend with ABM the existing silos?

Mr. SHARFMAN. The ABM technology that exists today, we believe, is incapable of defending a relatively small number of targets, 1,000 or less, against a big Soviet attack. The Army and its contractors are working on new technology which might have this capability in the future. These are frontier technologies. There are problems that they not only have not solved, they have not yet figured out how they are going to solve them yet. Decoys are one of the major such problems.

We don't think you can predict whether those problems will be solved in 5 years or 10 years. Hence, there is no way of knowing today in 1981 when you are talking about an effective ABM defense of silos, would become possible. It depends on whether you are talking about a very successful program or a program that had to deal with a series of possible Soviet countermoves over a long period of time, in which case it might well be the year 2,000 or so before you have an effective defense.

The same applies even more strongly to orbiting laser weapons or some other directed energy technology. The laws of physics permit it, the technology has been advancing very fast, but there is a long way to go. If I might risk a metaphor, it would be like sitting back in 1940 and trying to guess whether there might be jet aircraft transporting passengers. We are too far away from getting to the technology to have a good reliable projection of when the technology will be there.

It would be possible to decide to put MX in silos, rely for now on launch under attack and shift to reliance on ABM if and when ABM technology reaches the point where this is possible, but it would be taking a very great chance to say instead that we are confident that ABM technology will come along to defend silo-based MX by the time we need it.

MINIMAL MPS DEPLOYMENT

Senator GARN. What about a variant? What about what you might call a minimal MPS, where you put MX in existing Minuteman silos and we don't necessarily have to talk about 200, there is no magic number about 200, and you dig some additional holes, three more additional Minuteman silos. You have greater hardness. I would assume that would create problems of fractionalization. They could not fractionate as much with harder silos. Eventually you reach a point of diminishing returns on that but 600 PSI versus 300, they have to keep fewer large yield warheads and protect it with a site ABM defense and eventually go the way you are talking about, I agree with you about follow-on homing overlay defense.

Mr. **Sharfman**. We have not done a formal analysis of that option but we have looked at some of the issue that would arise. In the first place, on the silo hardness, our analysis confirms what you saw in the DIA briefing Tuesday, that whereas with the Soviet capabilities as they exist today they could have [deleted].

By 1990 their accuracy I predict at [deleted] meters. With [deleted] accuracy it does not matter very much whether it is a [deleted] horizontal shelter or [deleted] silo. They can get it with a single shot. It is a question of whether their missile is reliable in the first place.

Now if we built additional silos in the Minuteman field, we would want to move MX missiles around among them so that the Soviets would not know which silo holds the missile. In that case a very substantial upgrading of the roads in that area would be necessary because they in no way are capable of taking a vehicle comparable to a MX transporter. So, there is a major expense involved there and a major amount of time on construction.

Mile for mile it is easier to construct a very big road in the desert than it is in a place like North Dakota where it is winter for half the year. Of course if we cut down on the number of shelters, it would cut down on the mileage of roads, so the cost would go down and the feasibility would go up.

ROAD CONSTRUCTION COSTS

Senator **Laxalt**. What percentage of the total cost does the road construction represent?

Mr. **Sharfman**. We will have to make a submission for the record on that particular point. We also at the same time will give you a submission on the cost of the transporter. Of course, if there were even two silos per missile, we would have to buy a vehicle that is capable of moving the missile from one to the other without the Russians knowing which one it is in.

[The information follows:]

Road and Transporter Costs

The cost for roads was estimated to be slightly more than $1 billion (fiscal year 1980), or about 3 percent of total cost.

The cost of the transporter is estimated at about $8 million a copy.

NEW PROGRAM FOR MPS

Senator **Garn**. I don't mean to minimize your cost but also in the MPS as proposed, you are talking about everything new, starting from scratch.

Mr. **Sharfman**. That is correct.

Senator **Garn**. I was here for the DIA report and as I remember it seemed like they were talking about [deleted] percent is still a considerable difference out of 200 missiles. [Deleted]. That is [deleted] surviving warheads or more. I think [deleted] survivable warheads is not to be glossed over. I don't have the chart before me but I was looking at all those numbers getting up to [deleted].

Sure, you reach the point where they could be much more confident of [deleted]. Problem. Still there is a difference. [Deleted] is somewhat significant.

Mr. **Sharfman**. There is no question of that. We can, if you want, check the figures and give you a submission for the record on that. There is still the basic point that with an MPS system there is in effect a race between the number of warheads the Soviets have available and the number of shelters. A LoADS system, assuming that it works, assuming that you are able to solve this PLU problem of making the defense system and missile and decoy look the same to all the sensors the Soviets are able to employ effectively, doubles the number of shelters.

As I say, we took an independent look at the size of the Soviet threat in part to be able to present the numbers in an unclassified way which we could not do if we were relying on official DIA findings or CIA findings. Quite conservatively the Russians could have [deleted] in 1990 and you have to have more shelters than that if you want survivability.

ADDITIONAL SITES IN NORTH DAKOTA

Senator **Garn**. Senator Andrews told me he wants more holes in North Dakota.

Senator **Andrews**. I have not said I wanted more holes. I have pointed out that this business of poking more holes in the ground and running around the roads and trying to play who's got the pea with the missiles doesn't impress us a whale of a lot. I told my two friends, Senator Garn and Senator Laxalt, that up in North Dakota where we have been living with missiles for 15 years, putting more holes in the ground or building more ABM systems only to abandon them, does not make nearly as much sense to us as moving in and taking a look at another alternative.

RAILROAD USE FOR MX MISSILES

The alternative is rather unique because at this moment the Burlington Northern Railroad is announcing they are abandoning 1,100 miles of branch line. You go up there and take a branch line of 75-mile length or another one of 100-mile length and upgrade it so that it could carry 120-ton railroad hopper cars which ship grain. The railroad I have talked to is on an initial response willing to give you the track, the real estate, and the rest on condition that you upgrade the rail line.

You would have to deliver a couple of trains a week through there but it does not have the same type of head-on confrontation with civilian rail facilities. You could certainly get yourself a lot of movement there.

The Transportation Subcommittee just put $30 million into our bill with the support of my colleagues to rehabilitate 500 miles of the Milwaukee main track through South Dakota. A Government investment that represents about 40 percent is rehabilitating 500 miles of track and with 500 miles of track you could move a whale of a lot of MX missile trains if you simplify them. As I understand it you want to move them around so that they are not fixed targets for the Soviets.

That type of approach I think would make sense to the people in North Dakota and South Dakota and probably Wyoming and probably Montana where these tracks are being abandoned. Looking back in history, Hitler built the autobahn for military purposes but it sure served the civilian economy. The military has built these concrete monuments and then abandoned them.

If you can move them around on railroad tracks it would be better than moving them through the desert.

Mr. **Gibbons**. That is an attractive option. We did give some consideration to both road and rail options.

Senator **Andrews**. As I understand, 15 years ago when I was over in the House, Boeing built some rail cars to put the Minuteman on. You were going to put it on the normal rail system. Then you figured that the intermix with civilian traffic would be such that you probably would not want it. With the thing I am suggesting you would have a totally controlled use of these branch lines. The only obligation you would have to the railroad and the communities would be to run a couple of trains a week up and down, picking up grain cars or whatever.

Mr. **Sharfman**. You are correct about the previous work done earlier by the Defense Department and by Boeing. As a rough approximation you need about 6 miles of rail line for every megaton the Soviets have if you want to start approaching survivability. Now the Soviets have got some thousands of megatons deployed now. They would have the possibility of increasing that number between now and 1990 if they felt it was in their national interest.

They are capable of it if they decide they want to.

ROAD REQUIREMENTS FOR MISSILE TRANSPORTATION

Senator **Andrews**. How many miles of road in the desert do you need for each megaton?

Mr. **Sharfman**. Because of these shelters that are [deleted] the Russians have to drop a missile within a few hundred feet of the shelter—how many depends on the yield of the missile—in order to destroy it. If you are on a rail car, a rail car does not have [deleted].

Senator **Andrews**. You are talking in North Dakota of coming up there and building 500 to 1,000 or 1,500 more silos. What I am saying is that you come up and build your horizontal shelter. If you put a thousand horizontal shelters in a State like North Dakota, the horizontal shelters should not cost you as much as the silo. They are just right along those rail lines. You could move them from one to the other. Right now you are running missiles down our roads. You have a lot more interface with the civilian economy when you are running missiles down the road. You would have far more if you were running them from silo to silo, put them on rail and build your horizontal shelters on switchbacks off the rail. If you can't find 25 shelter locations on 75 miles of branch lines someone is crazy.

POTENTIAL PROBLEMS WITH MPS SYSTEM

Mr. **Sharfman**. That would be a very attractive concept from the point of view of limiting the adverse regional impact. In fact to the extent that it made it possible to keep open a rail line that might otherwise be closed, it would have a positive regional impact. It would not affect the other two potential problems with a MPS system.

First, the costs associated with the possible need to build a very large system indeed in order to prevent the Soviets from overwhelming it. There is no reason to suppose that the system you described would be much cheaper, significantly cheaper per shelter and per missile, than the base line system. It is true that you have the rail lines already.

Senator ANDREWS. I am not saying it will be much cheaper. I am just saying integrated as it would be with something that could be used by the civilian economy if, when you move from this family of, shall we say, defense operations onto the next, we are still left with something salvageable other than holes in the ground that we now have in North Dakota.

Mr. SHARFMAN. That is a point.

TRAIN BRANCH LINE ALTERNATIVE

Senator ANDREWS. You know, we have these missile people running around those roads all the time now. These tracks that are being abandoned in 150-mile chunks lie in the territory you now have, your little hutments and control centers down below, and your pickups running up and down the roads and transporters running on down gravel roads. The rail lines would not impede the movement of missiles in the spring.

If you came up with a multisilo operation that you have been proposing in the press, you would have to be moving those missiles around on roads that simply won't carry the missiles for 3 months out of the year. So for 3 months the Russians would know that you could not move from silo to silo. So, I would think that with the train branch line alternative you could.

Mr. SHARFMAN. I would make one point on the local impact. At the present time the missiles are disassembled before being moved. They are assembled in their silos.

Senator ANDREWS. Then you run the atomic warhead around in a separate dingy and you put the major missile in the big trunk.

Mr. SHARFMAN. In order to keep the Russsians from knowing where on this branch railroad line the missile was, what horizontal shelter it was in, you would have to move the whole missile at a time. Now you could fit it on a railcar but you would have to think a little about how close to that branch line civilians would be permitted to come because you have coming down the track 10 nuclear warheads and a number of tons of rocket fuel. The Department of Defense regulations as they stand would allow that because it is an operational system, but it might not be enormously popular if the branch line runs through a small town and the people in the small town see these trains coming by and wonder what is inside them.

Senator ANDREWS. What do you suppose they think about the B-52's sitting out there within 2 miles of two of our principal cities that are loaded with arms and ready to go at any time? One caught on fire a few months ago. They say "Oh, we will have a big atomic explosion." I had to tell them no way, you are not going to have an atomic explosion from those missiles going down that track.

Mr. SHARFMAN. You might have a good size chemical explosion from the rocket fuel but you would not have an atomic explosion.

Senator GARN. We have trains with chlorine. There is not a year that goes by that we are not moving chemicals through small towns in this country that are evacuated. I think you are in more danger from stuff you move on the freeways, chlorine, toxic chemicals, than any other type of this kind.

Senator ANDREWS. All I am saying is that if you want a land-based MX, don't come at us to poke more silos in the ground and run them around on the roads. Don't obviously go out in the desert and build this big infrastructure. One of the possibilities that might sell is putting two or three missiles on a branch line and two or three missiles on another branch line.

I would imagine, Paul, you have branch lines in Nevada. People wouldn't mind if you had missiles running arond and going into four or five shelters but this mammoth thing in the desert gets everybody up tight.

I would appreciate any response you might have. I think it is extremely important for this country that we maintain a land-based missile capability that is movable enough so that it is survivable. If that fits with something that also makes sense from the standpoint of the civilian side of the economy, it ought to merit your looking at it. That is the only reason I suggest it. If you want to take all the missiles out of North Dakota I think the people would be happy to have them someplace else. I think you ought to put them in the Granite Hills of New Hampshire so that if the Russians go after them the nuclear cloud moves out to the Atlantic.

But I have a friend that sits in the subcommittee with me that does not feel too happy about that.

BOTTOM LINE POINTS ON MX AND MPS

Mr. SHARFMAN. Let me say that we did not study that particular option. Our basic bottom line points about MX and MPS were four: First, it would offer very high military effectiveness and capability in a number of ways and that should apply to what you are proposing. Second, a very large system might be needed and that could make the cost very high indeed. That would still apply. Third, the regional impact would be severe and adverse, that might not apply. Fourth, it would be necessary for the preservation of location uncertainty to work, that we succeed in fooling the Russians. That is a tough job. We have not yet gotten to the stage that it has been prototyped. That would still apply with the addition that shifting from road to rail would probably involve redesigning some so the components and therefore an additional delay.

Senator ANDREWS. Make them look like grain hopper cars and the Russians would get so damn confused in that 6- or 7-State area they would not know what to shoot at.

Mr. GIBBONS. I might spend a moment comparing costs and be open to further questions. There obviously are great uncertainties in making cost estimates on systems that have not been built or tested. In our analysis we try to compare costs of options for which there is some test data available with costs for systems that have not even been designed yet, such as the exo-atmospheric ABM.

COMPARATIVE COST CHART

Because some basing modes involve higher operational costs than others, some are more captial intensive and some are more operational intensive in cost. We feel the most meaningful comparison would be on the basis of total cost for acquisition and operation by the turn of the century all measured in 1980 dollars. I have brought to you this morning a chart of comparative costs that you may wish to scan.

[The material follows:]

Summary, Lifecycle Cost Estimates for Basing Options
(billions of fiscal year 1980 dollars)

	MX/MPS baseline	MX/MPS expanded 1990 threat	MX/MPS expanded 1995 threat	MX/MPS vertical shelters	MX/MPS split basing	Small submarine	MM III MPS	MM III expanded 1990 threat	MM III expanded 1995 threat
Number of shelters.	4,600	8,250	12,500	4,600	4,600	51*	5,800	10,400	15,500
IOC/FOC (calendar year)	87/89	87/89	87/94	87/89	87/89	89/95	87/90	87/91	87/94
Number of deployed missiles.	200	359	544	200	200	204	667	900	1,100
Development.	$ 9.172	$ 9.372	$ 9.572	$ 9.172	$ 9.172	$ 7.225	$ 2.527	$ 2.500	$ 2.500
Investment	27.999	43.557	61.512	26.500	30.109	24.862	28.037	43.200	60.400
Total acquisition.	$37.171	$52.929	$71.084	$35.672	$39.281	$32.087	$30.564	$45.700	$62.900
Operating and support to year 2000.	$ 6.308	$ 9.482	$11.486	$ 6.308	$ 6.526	$ 7.160	$ 5.907	$ 7.700	$ 9.500
Lifecycle cost to 2000 . .	$43.479	$62.411	$82.570	$41.980	$45.807	$39.247	$36.471	$53.400	$72.400

*Submarines.

SOURCE: Office of Technology Assessment

ADDITIONAL SHELTERS 1990–95

Mr. **Gibbons**. I will be pleased to answer any questions in any area we have talked about.

Senator **Garn**. Your 1990–95 cost is simply additional shelters?

Mr. **Gibbons**. MX/MPS 1990 versus 1995 would be additional shelters and missiles. We assumed a constant ratio of 23 shelters per missile.

Senator **Andrews**. You are contemplating to move up and build additional silos in present Minuteman locations?

Mr. **Sharfman**. That would be to remove Minuteman from some existing silos, modernize those silos and put MX missiles in these silos and then buy some of the better sensors, better communications equipment that we were describing earlier in order to make the "launch under attack" option more robust.

POLICY IMPLICATIONS OF LAUNCH–UNDER–ATTACK PHILOSOPHY

Senator **Garn**. They emphasized before you got here that their option was MX in the existing silos and launch under attack was by far the cheapest option but they cannot assess the policy implications.

Mr. **Sharfman**. With regard to these threats, since it does not appear directly from the chart what we are talking about, as I said a few minutes ago, we did an independent assessment of what the Soviet threat might be. We felt that on a very conservative basis the Soviets might by 1990 have [deleted] that they could devote just to MX. DIA was briefing an inventory of [deleted] would not attack MX, some of which would be used for other purposes. To get to that [deleted] number you have to make some assumptions. For example, that the Soviets would apply some submarine-launched missiles to attack the MX. We made the contrary assumption that they would use only ICBM's, that they would hold back some of their ICBM's to secure reserve force.

Senator **Mattingly**. Those are your assumptions?

Mr. **Sharfman**. Yes. I am trying to contrast DIA's assumptions with ours. Making very conservative assumptions, giving the Soviets credit for wanting to be very careful in what they do. Holding back the force for other missions, they could have by 1990 [deleted] RV's with no mission except to attack MX. If they then kept building at the same rate they could get to about [deleted] by 1995.

So, this 1990 and 1995 has to do with when the Russians just give it up as a bad job. Presumably if the Russians felt that no matter how many they built we were still going to keep adding shelters, possibly LoADS units and additional MX missiles, the Russians might get the idea that the more they build the worse off they are and stop.

The cost to us of doing that depends on the year in which the Russians decide to stop building more RV's because it is not getting them anywhere, but with the proviso that after they make the decision it might be several years more before we were sure that they had in fact made that decision and we would not want to stop before we knew they had stopped. I doubt that we would do it on the basis of a public speech made by the secretary of the Communist Party. We would want to wait until we had hard evidence.

ANALYSIS OF SOVIET STRATEGIC SYSTEMS

Senator **Mattingly**. Who makes the presumption about what they will build?

Mr. **Sharfman**. In our case we contracted with Booze, Allen to have this work done by Sayre Stevens, assisted by Vern Lanphier. Stevens was for a number of years in the CIA and the part of the CIA that does analysis of Soviet strategic systems. What he did was to look at past Soviet building programs for missiles over the last 10 to 15 years. That is, the date on which each new missile came on line, the date on which each new modification came on line, the rate per year at which new missiles were deployed, the rate per year at which new warheads have been deployed. Then he just projected postdeployment rates into the future. If the Russians could do it in 1979 there is no reason why they can't do it in 1982.

Senator **Mattingly**. Did you do the same type of analysis if we put one MX in a silo, what deterrent effect that may have as far as what they do?

Mr. **Sharfman**. In fact we had them look at two different cases. Case one in which the Soviet response to MX is to attempt to overwhelm it by building more warheads; case two in which the Soviet response to MX was to seek survivability for their own missiles. In case two they would have substantially fewer warheads. Even in case two, 4,600 is a kind of marginal number. We would probably want to go to larger size deployment or else to a LoADS. Case two certainly doesn't lead to the same kind of high numbers as in case one.

The problem is that it will be several years in the future [deleted].

So it would be some time in the [deleted].

NATIONAL POLICY ON MX

Senator **Mattingly**. Which gets back to Senator Garn's initial comment about the national policy. He was commenting on whether it should be public, which it probably should not be. I would hope that the policy the President is pursuing is the same as the one Senator Garn and I pursue. We have gone through something like 30 some odd whatever it is, studies on MX that in fact, you know, by 1983 we need it, make a decision by 1983.

Mr. **Sharfman**. On construction at any rate. That is assuming a 1981 decision to do it in the first place.

Senator **Mattingly**. Irrespective of that decision, there would be decision made prior to that to make sure our country has greater option, whether it be putting MX's in silos or whatever it may be, to, instead of waiting, to look at 1990 and see what the Russian policy was for 1985. I guess what I am getting at is the survivability of a missile is one thing but irrespective of its survivability, whether it is 30 seconds or whether it is 30 years, it still creates an option for our country that we didn't have before, is that right?

Mr. **Sharfman**. Certainly.

Senator **Mattingly**. I guess I am getting back to the beginning of what Senator Garn was talking about that I thought was so significant and so important.

RECOMMENDATIONS TO SUBCOMMITTEE ON ALTERNATIVES

Senator LAXALT. Have you people, based on the cost, based on the pluses and minuses that you have on capability, enumerated for us, developed a list of priorities, considering all the factors for this committee to recommend or to consider?

Mr. SHARFMAN. We have developed a list of criteria but we have not in fact prioritized these criteria.

Senator LAXALT. Do you have any specific recommendations to this subcommittee as to where we should go considering all these factors, political, economic and all the rest of it?

Mr. SHARFMAN. No, sir, we do not. We have considered each of the ways in which you could go. We have identified some that are feasible, but have problems.

MISSILE BASING ALTERNATIVES NOT CONSIDERED

Senator LAXALT. In your estimation should we forget surface ship for the reasons you mentioned?

Mr. SHARFMAN. Yes.

Senator LAXALT. Should we forget air mobile?

Mr. GIBBONS. There are some good reasons for forgetting them.

Senator LAXALT. And small subs? I gather the principal difficulties are political because of our allies raising strong concerns about compelling them to go land based and we go water, and apparently the shipyard problem we have in terms of construction.

Senator GARN. Shipyard problem and capable people.

Senator LAXALT. Construction or operation.

Senator GARN. You don't use a welder who is constructing the Hart building next door to weld a submarine.

Senator LAXALT. I hope not.

Mr. SHARFMAN. We think that there are five ways to go that are worth considering.

Senator LAXALT. Recap those for us now.

COST ESTIMATES OF SOVIET MISSILE SYSTEMS

Senator ANDREWS. Can I get one question in? You threw these figures out, 4,500 shelters, the Russians 4,500 RV's. You said the Russians have [deleted] RV's but you did not tell the subcommittee, I do not think, what does it cost the Russians to build and maintain a RV versus what it costs to build and maintain one of those shelters. If it costs them three times as much or four to maintain a RV as it does us to maintain a shelter, that may or may not have a missile in it, they will not keep on with this kind of hoorah if they are at a price disadvantage to us of 4 or 5 to 1. What is the cost differential?

Mr. SHARFMAN. Estimates of costs to the Soviets are a very dicey business. Their published defense budget is a work of fiction.

Senator ANDREWS. I am not talking about percent of gross national product or anything else. I remember when we abandoned ABM it was abandoned because the treaty said we are limited to 100 defensive missiles. They pointed 100 offensive missiles at our 100 defensive missiles. It cost them one-third as much to maintain offensive missiles as it did for us to maintain defensive missiles, so the cost effectiveness was not there. That is why we went away from that. Had we been able to maintain 800 or 900 defensive missiles around that computer and radar, it probably would have been cost effective and even though technology has passed it by, even when it was opened, it would have stayed there.

But you are not giving us the figure of what the cost effectiveness is based on our cost figures. What does it cost for RV versus shelter?

Mr. SHARFMAN. Roughly speaking [deleted] a shelter.

Senator ANDREWS. You mean it costs as much to build a shelter [deleted].

Mr. SHARFMAN. William Perry, when he was Under Secretary of Defense for Research and Engineering, testified to the Armed Services Committee that the [deleted] as the cost for us to build an additional shelter and keep it on line. We are pretty sure it is nothing like a 4 to 1 or 2 to 1 ratio but it might be [deleted] ratio in either direction.

Senator ANDREWS. If missiles are this cheap why do we play with the idea of not having a missile in every shelter?

Mr. SHARFMAN. The Russians have a lot of RV's already. We don't have any shelters at already. We would have to play catchup. If we once caught up we could stay even with them for the same amount of money. But there is a lot of money, tens of billions of dollars, to get to the point where we are even.

They have those RV's already.

Senator MATTINGLY. You have a national policy for years that didn't let you do that.

TRIDENT II VS. MX

Senator GARN. We dug our own pit. Now we are trying to fill it up.

Can I clear up a couple of more things? Getting back to the small submarine and ability to locate them and so on, my question on Trident II versus MX, on that small submarine you are going to have 40 RV's. You would have 224 on a Trident. So you have a considerable difference there, in other words, looking at that small submarine, its ability to carry.

C^3 SUBMARINE

I want to get into the C^3. Have you done any looking into that at all?

Mr. GIBBONS. Yes, specifically a fairly extensive review of that.

Mr. SHARFMAN. You mean submarine C^3?

Senator GARN. Yes.

Mr. SHARFMAN. There are a number of ways in which existing systems for submarine C^3 could be upgraded during the same time it would be taking you anyway to build the submarine and build missiles. The cost of doing so would not be exorbitant in relation to the cost of building the whole system. We have included some C^3 upgrades in the cost figures which we have just described.

Ash, do you want to give us a fast rundown on the system?

SUBMARINE BASING

Mr. **Carter**. The things that we have looked at for submarine basing, to give it the same capability as land basing in regard to C^3, as much as we can, are quite different from those used for our present SLBM force. Submarine basing has two principal hurdles that one must get over with regard to C^3. The first is water. Electromagnetic waves except those at low frequencies don't penetrate the water. So, you are either above the water communicating or below the water and have a different problem.

The second is report back or transmissions from the submarine itself to its commanders and whether these transmissions compromise its location.

Now, with regard to the first, during peacetime you could have the same VLF network that we have now, very low-frequency network, which is low-data rate but adequate for normal traffic and adequately rapid dissemination of emergency action messages if you wanted to strike.

As regards report back, the present means by which submarines report back are classified and involve considerable risk of compromising the submarine's location. What we have looked at for the possibility of report back is the use of satellite communications at extremely high frequencies. This is a very closely collimated beam to very survivable satellites, deep space satellites if you want, and because the beam is so collimated when the submarine reports back no one around it can figure out where it is. That kind of communication does not betray the location of the submarine. That involves sticking up a mast antenna, a small 5-inch dish above the water, and there is a question of whether that is a problem, itself. Ted can talk to that but he believes not. In any event 10 to 12 percent of this force is snorkeling at one time. So for a limited nuclear option, 10 percent of this force is sitting out there snorkeling at any one time and then has rapid, high-data rate, continuous two way communication with its commanders.

So, using in peacetime the VLF network, in the transattack period the improvement to our TACAMO fleet, which is going in now, in the postattack period and for preattack report back transmission these EHF satellites, we believe taken together, these upgrades could satisfy the requirement that we desire of C^3 for land basing. So it is possible. We have to work at it.

SILO HARDNESS

Senator **Garn**. Getting back to the hardness of silos, a hypothetical situation. Suppose you have 5,000 PSI, 3,000-feet apart, would that not be getting back to requiring 1 on 1 to reduce the fractionalization?

Mr. **Sharfman**. How many PSI hardened, 3,000-feet apart?

Mr. **Staffin**. We have not looked at this case explicitly. However——

Senator **Garn**. I was talking about fratricide.

Mr. **Staffin**. Three thousand PSI, I think it is a good guess to say that what would be concerned——

Senator **Garn**. Five thousand PSI.

Mr. Staffin. Well, 5,000 PSI as a hardness, I would say that in discussions with the nuclear effects community, at this kind of hardness what they would be most concerned about the effects of electromagnetic pulse radiation, somewhat akin to the effects of a lightning bolt.

There exists the possibility of spacing the warhead attack with sufficient time on target control to make a quick "cookie cutter" attack where each individual shelter, although it is mechanically very hard to ground motion, as hard as you can make vertical shelters (unlike horizontal shelters), the effects of electromagnetic pulse make it much more difficult to get such high hardnesses.

Therefore, the tenative expectation is that although it would be risky to attack them 1 on 1 because of fratricide effects, it would be risky for the defender to assume that the attacker could not space the war heads cover an area where the missiles electronic components could not be destroyed by the effects of electromagnetic pulse.

USE OF ABM IN DISRUPTIVE MODE

Senator Garn. I want to throw out one more thing. Current ABM's used in a disruptive mode along with that kind of spacing, would that not place some rather great uncertainties on the Soviet commander deciding what to do?

Mr. Carter. When you have a very closely packed network of shelters which you are defending, so that the Soviets have to put several warheads on each shelter in this very closely packed way, that does increase their anxiety about fratricide. Studies have shown, however, that it is possible to lay down several RV's on each shelter on a closely packed network.

Senator Garn. That is why I throw in existing ABM technology to produce uncertainties, not that it is going to stop them all by any means, uncertainties to close this gap until we see what happens to the overlay homing type in the future.

Mr. Sharfman. Constructing this network of silos we are talking about is a major project. A 5,000 PSI silo is not an easy thing to construct.

Senator Garn. I understand. When you are talking about a project which is the biggest in the history of mankind, it does not scare me at all when you talk about bigness. I saw the Pyramids a few weeks ago and they are kind of tiny compared to what we are going to do.

Mr. Sharfman. The information we have on [deleted] this hearing.

Senator Garn. We already talked about it the day before yesterday, so you don't need to repeat it.

Mr. Carter. Studies not conducted by us but by the ballistic missile defense community have shown [deleted]. Whose anxiety would be greater?

Senator Garn. I am talking about trying to create more uncertainty. I am not a technician, I am not a scientist. I am talking about politics now, I guess. Create uncertainty about what we can do and how successful we will be. From what you briefed me in April and from what you are briefing today there are no good options. Every one of them has major significant problems and major uncertainties as to how much they will cost and how well they will work.

Mr. **Gibbons**. That is right.

Senator **Garn**. That is what I am talking about. If we can do something that will create those kinds of uncertainties in the Soviet Union, put them to the same kind of guesswork that we are going through, that is a significant deterrent in my opinion.

Mr. **Gibbons**. That brings me to the issue of should we try to tell the committee which mode output to be chosen. We think that should not be OTA's job. Rather we try to narrow the numbers of things looked at to those that are most defensible for one reason or another and then try to give what we see are the major strengths or weaknesses of each of those options.

We think that we are at a number certainly not greater than five options. I believe you gentlemen have brought up today some other approaches to strategic defense that are very interesting and very important to be considered We have narrowed the issue. We hope in doing this analysis and trying to keep an eye on the direction of technology development over the next decade or so that we help narrow at least the focus of what seems to be the most plausible way to go.

PLU AND ABM TECHNOLOGY

Senator **Laxalt**. Do you people have more faith in the prospects of PLU technology or ABM technology or are they equally uncertain?

Mr. **Sharfman**. It is question of which ABM technology.

Senator **Laxalt**. LoADS?

Mr. **Sharfman**. The major doubt about LoADS is in fact its compatibility with PLU. So the two merge together. There is the problem that you are expecting LoADS to track an incoming RV with a radar, process an enormous amount of data from the missile while a megaton range nuclear explosion is going off a mile away, and this LoADS unit is not bothered by that and it continues to track and fire. This is a tall order. To do that you have to build it pretty solidly. The more solid it is the harder it may be to match the missile with a decoy and then you have interaction with the PLU problem.

Mr. **Gibbons**. Especially if you think of more than one RV coming at each site; defending against more than one would be an extremely difficult thing to do.

Senator **Laxalt**. Did I understand that if they do come with more than one RV at one site, the present technology LoADS is not all that fensible?

Mr. **Gibbons**. More than one?

Senator **Laxalt**. Yes.

Mr. **Gibbons**. That is correct.

Senator **Laxalt**. Is that the essence of that testimony?

MINIMAL MPS

Senator **Garn**. That is, if you have single missiles and single silos. General Burke talked about going to 6,900 shelters, to create uncertainty, and LoADS. It depends on what you are trying to defend. If you are trying to defend just silos and there is a missile in every one of them, then they are saying it is not effective. That is why I am talking about minimal MPS, start solving that problem.

Mr. SHARFMAN. It becomes a numbers game. To take an example, if you had a MPS system and LoADS combined that was designed to meet the same size threat, 4,600 shelters, 200 missiles with LoADS, you need about 3,500 shelters, about 150 missiles and about 150 LoADS defense units. That is roughly the least cost mix. That still is not small. That is still quite a good size deployment. That is good against what you could call the base line threat. Then if the Soviets do chose to increase their number of RV's, you have to increase the number of shelters and increase the number of missiles and increase the number of LoADS units. My recollection is that one of General Burke's charts, the one that dealt with the U.S. response to the highest Soviet threat, was envisioning 9,200 shelters, 350 missiles and 350 LoADS units all deployed by 1990.

If we can do that, then the Russians probably don't have what it takes to overwhelm it, but that is an enormous deployment, very fast and a tremendous impact, tremendous dollar cost. It is basically a numbers game. We have to do enough to deal with whatever it is that the Soviets do, operating from a disadvantage that there is a gap of several years between their decision of what to do and our getting enough evidence to handle it.

LAUNCH UNDER ATTACK

Senator LAXALT. Does that make launch under attack all the more appealing as a deterrent?

Mr. SHARFMAN. You could say that.

Senator LAXALT. Isn't that a rather quick catchup in terms of policy? All we have to do now, as Senator Garn said, is to backfill.

Mr. SHARFMAN. That is right, but you still come up against the question of whether launch under attack involve risks that you are uneasy about accepting. There are of course two risks there. Whenever you have a hair-trigger situation you can always build a safety catch. If the safety catch is too good that is a risk. You have the opposing risk that the Soviets would attack and we have so many built-in safety mechanisms that we would not launch or the risk that we would have too few safety mechanisms and somehow, some way an error would occur and we would launch by mistake. You are walking a tightrope between two different kinds of errors in designing that system.

There is nothing in the laws of physics that says it can't be done. There is nothing about today's electronic technology that says it can't be done, but you want to be awful sure that you are in fact doing it right and that you haven't made some dumb mistake in designing the system because the consequences of error are catastrophic.

Senator MATTINGLY. It is not riskless though, any decision.

COMPARISON OF SYSTEMS

Mr. **Sharfman**. Perhaps, Mr. Chairman, in response to your question on recommendations it would help if I ran quickly through the criteria we have used to compare the systems.

Senator **Laxalt**. Why don't you do that to recap because we are running out of time too. We will be going to the floor in a little while.

Senator **Garn**. I want to make a comment before your recap. The more I listen to all the technical experts and hear the numbers games it seems to me that far more important than any of that is something I have alluded to several times before which is the psychology. I think the Soviets feel that for the last decade we have been incredibly naive to allow ourselves to get into this position. If you read Fulbright's testimony—sometimes I would like to refer to him as half bright.

Senator **Laxalt**. That is original.

Senator **Garn**. No, that is not original. I heard it many years ago. I am sure they were sincere but incredibly naive about Soviet intentions. It seems to me we can't solve this problem with any numbers or catchup rapidly enough. It seems to me it is more a matter of the President convincing the Soviets that we have the will and that is the only real deterrent we are going to have, whether that is launch under warning or they just feel this is a President or the President after this one during this period of the 1980's, that won't continue to take this crap and somehow the liberals of this world will have to recognize what causes war is weakness, not strength.

I think if the Soviets don't have that perception of us we can't build any of these things fast enough or spend enough money to defend ourselves. I think we have to have an attitudinal change in this country that is philosophical, not numbers, but the numbers are getting kind of boring and none of them seem to be any good answers.

Senator **Mattingly**. You made the comment about making sure what we do is correct. It is not a riskless society. I hate to draw something from a cartoon but when Peanuts says that indecision is a terrible thing I think that is sort of the mode not that you are in but everybody has been in. I am not so sure whether you ought to completely dwell on numbers in this dialog because until you make a decision, until you start restoring the capability, how are you going to give the President an option on which to make policy decision?

I think what Senators Garn and Laxalt are saying is right. Now is the time to draw the line. We are going to have to take the risk.

Senator **Garn**. When you scare them badly enough they are willing to sit down and sign a reasonable SALT treaty.

Mr. **Gibbons**. I would like to add a couple of personal comments. One is that much as we would like to have numbers lead us to a very definitive decision, it is clear that they lead us to a limited number, a finite number, but still more than one option to be decided upon. That decision therefore has to be made on other bases.

Second, it may well be that the credibility of a national resolve is far more important, as you pointed out, Senator Garn and Senator Mattingly, than numbers.

Third, that during the window of vulnerability in the 1980's and even for the 1990 time period, if we have a credible national resolve it must be backed with very real options that can be taken and a system of control that is sufficiently sophisticated, convincing sophisticated, that Soviets can be well assured that we are not going to make an accidental launch but that we do have options that we can exercise.

Senator LAXALT. Does somebody want to recap?

OPTIONS INVOLVING RISKS

Mr. SHARFMAN. I would like to begin by picking up from what Senator Mattingly said that indeed we have identified options that we think are worth serious consideration. All of them have risks. There is no riskless way of basing MX. The issue is what kind of risk do you find least objectionable because the risks are of different kinds. Let me now on that basis run through the criteria and suggest how these five systems stack up against them.

First is technical risk which has to do with the degree of confidence you have that the system will work as designed if you build it. Of the five systems, none of them has prohibitive technical risks but we do want to call attention particularly to the problem of PLU, of preserving location uncertainty for any MPS system. That problem is compounded if you add LoADS because you then have to have a decoy, a LoADS system and a missile, all of which are indistinguishable to Soviet sensors. Finally, I would point out that the risks from launch under attack are of a different kind. They are not technical risks, they are risks having to do with the integration of a complicated but feasible technology with a national decisionmaking process.

SURVIVABILITY OF BASING SYSTEMS

Survivability, the second major criterion. We define, of course, a system as survivable if we don't think the Soviets would be able to destroy us if they try. That could include accepting some attrition. An MPS system is designed with the idea that the Soviets can destroy some of it but not all of it. It could be, as in the case of launch under attack, the idea that by the time the Soviet missiles have arrived the force has already been fired and the Soviets have failed to destroy it.

With regard to MPS, survivability is contingent on PLU working and it is contingent on the system being large enough to insure survivability.

With regard to air mobile, survivability is contingent on getting those planes off the ground fast when warning is received. It could be a problem that this is also a condition for survivability of the bomber force, which is another leg of the Triad. As you may know, under present procedures those bombers do not get off the ground very fast if there is a warning, and there is some risk to their survivability as a result. Those procedures exist for good reasons but you have to deal with that problem if you want to have twice as much of your strategic force dependent on getting down a runway and off the ground in a tremendous hurry the moment a warning is received.

With regard to the submarines, as Dr. Gibbons said, we have been unable to identify any scientific principle or any technology that ought to make them vulnerable.

You can't prove a negative though. You cannot totally exclude the possibility that the Russians won't think of something that OTA couldn't and all the people that OTA consulted couldn't. But there is a point that in the past the advances in antisubmarine warfare have tended to be incremental rather than drastic changes. If there are two kinds of submarines at sea operating in different areas and in different ways, incremental improvements in ASW are unlikely to get at both of them at the same time in the same way.

ENDURANCE OF FORCE AFTER INITIAL ATTACK

Endurance is another criterion that I don't believe we have touched on yet this morning. It has to do with whether, if the force survives an initial attack, it can endure as a survivable working system for some period of time thereafter. The MPS system, the baseline system, has been designed to provide endurance on the order of a year which is better than the endurance of any system we have now by a wide margin. The endurance of submarines would depend on how long they had been at sea at the moment a war took place. Their endurance ends when they run out of consumables, fuel and food, and could be restored if they could get a supply of that without making themselves vulnerable to attack.

An air mobile system would have endurance only if the Russians chose not to attack the airfields on which it could land. If you imagine a wide bodied jet carrying missiles, there are a lot of airports around where it could land. The Russians could destroy every one of them, but for the Russians to attack the major civilian U.S. airfields might represent an escalation of the war they would not want to carry out. You would have to say that endurance of an air mobile force is in the hands of the Russians rather than in our hands.

Launch under attack has no endurance, virtually by definition.

LoADS has endurance only if the Russians are unable in a wartime situation to take a good hard look at what shelters had survived, because those are the ones that LoADS were protecting, and take a good hard look at where LoADS missiles would have broken through the shelters to be visible. That again is an imponderable. If the Russians had during the war the same reconnaissance facilities they have in peacetime, then LoADS has very little endurance. On the other hand in a war presumably we would be doing something to the Russians, capability at the same time they were doing things to ours, and it becomes an imponderable what kind of intelligence means the Russians would have once the war is underway.

WEAPON EFFECTIVENESS

Weapon effectiveness is another criterion—missile accuracy, responsiveness, time on target control, et cetera. Land-based systems, whether you are talking about a MPS or MPS with LoADs or silo basing with launch under attack, set the standard here. We do think that submarines or air mobile could, with an expenditure of effort and money, be made very good. They could be made better than the Minuteman is today, for example. They could be made better than the minimum design requirements for MX. There is a question as to whether a small increment of yet-better accuracy or yet-better responsiveness that land basing would have, would have military significance. That is in the 1990 time frame.

COMMAND, CONTROL, AND COMMUNICATIONS

Command, control, and communications. We have looked at all the systems against that. There we found it is a wash. Each basing mode has very different means of C^3 but there does not seem to be a basis to prefer any of these five systems on C^3 grounds.

ARMS CONTROL

Arms control considerations. You have the question of compatibility with existing treaties. The ABM Treaty reached at SALT II, requires amending or withdrawing from that treaty to deploy LoADS. You have the question of compatibility with SALT II. You had a dialog with General Rowny on Tuesday as to the extent to which SALT II binds us and I don't want to get into that.

Also, the question of the impact on future negotiations, the question of the degree to which you create incentives or disincentives to a future arms race. What we say here generally is that silo basing and submarines are familiar systems. They fit within the framework of arms control as it has been carried out. They would not create additional problems with regard to arms control. Some people think that there are enough problems as it stands with where arms control is.

Any ABM system that was effective against a large Soviet threat would be incompatible with the existing treaty and you would have to do something about the treaty. The treaty, was, we think, very well drafted to make only ineffective ABM systems legal.

MPS SYSTEM

MPS system. The base line MPS system has been designed to be compatible with arms control, albeit with some stretching around the edges. If the Russians were to deploy a system like our MPS, we have to get them to agree to adhere to certain operational procedures if we wanted to verify. We are prepared to carry out those operational procedures ourselves.

Of course they don't have the same verification problem we do because we have an open society. The Russians could agree to these operational procedures, but whether they would choose to do so, whether they would feel it was in their national interest to make such an agreement, is another question. They have been resistant in the past to arms control agreements that limited their procedures.

There is finally the point, still in the arms control framework, that MPS is a numbers game. It seeks survivability through size. To the extent that we go in a MPS direction, it does create an incentive to worry about the relative size of the forces, an even greater incentive than may exist now, that could raise problems from several sources.

In the first place if we have an arms control agreement that we think limits Soviet RV's and if the Russians know that this limit on their RV's is very important to us, we might find it difficult, we might find it expensive in terms of bargaining chips, to get them to agree to a continuation of that agreement. Or if we don't have an agreement limiting their RV's and we obviously want one, we could find it difficult to get the Russians to agree to a limit that we so obviously want. Furthermore, while we were in the process of building up to a level of survivability we would be vulnerable—let us put it this way—it would be difficult for us to agree to stopping that deployment at a point where it was not yet survivable, and that could make the conduct of arms control negotiations difficult. Of course if this scenario took place, and it is a scenario, it is not a prediction, but if the Russians try to overwhelm our system, and we build up very fast and very big to persuade them that overwhelming the U.S. system is a lost cause, then by the time we had persuaded them that they could not overwhelm our system, a very substantial arms race would have already taken place.

INSTITUTIONAL CONSTRAINTS

Institutional constraints. Again we have not touched on that so far. The Navy has not shown much interest in putting MX to sea and the Air Force as far as we can determine opposes putting it to sea. That is not a technical question but it is also not a question that can be ignored. There is a political consideration that Dr. Gibbons mentioned, the larger political issues of a shift from land to sea as well.

IMPACTS ON PHYSICAL ENVIRONMENT

Impacts on the physical environment. The impact of MPS in Nevada and Utah would be large and would be severe. The impact of the other options would be confined to smaller areas, for example, the immediate area surrounding each of three submarine bases, or if you have silo basing, a very small impact having to do with modernizing the silos. Whether those impacts would be positive or negative would depend on the precise area concerned, the state of the economy, and how you built the thing.

Similarly with socioeconomic impacts, they would be severe and negative in Nevada and Utah. They might be either positive or negative for other basing modes depending on the economy of the region.

Cost I believe we have covered.

SCHEDULE

As noted there are two separate issues, three issues in fact. One is when you get the first missiles on line; second, when you can say OK, we have built this, we are finished. Third, when the system is survivable. If you are concerned with getting missiles on line in a hurry, then silo basing or MPS looks good. If you are concerned with getting the job finished in a finite time, MPS might be very bad. It would be in the hands of the Russians, not our decision. It would be how they respond and how we respond to them.

If you are concerned with survivability, then it looks like something of a wash. You end up with a date very much like 1990 for any of these to be survivable. I would note that launch under attack, although the President could institute it tomorrow morning with a stroke of a pen, can't be viewed as being as reliable as it ought to be until we got those additional sensors up into orbit, and all the communication links in place and that would take a long time.

Senator GARN. How long?

Mr. CARTER. It would take until the end of the decade.

Senator GARN. So you are coming up with 1990 on everything?

Mr. SHARFMAN. That is right on survivability. That is how long this window of vulnerability is.

STABILITY

Finally the question of stability. Survivability does, we think, add a measure of stability to a crisis situation. It is desirable from a point of view of stability that the systems be survivable. There are other aspects of crisis stability as well. You would not want the operation of the system to make a crisis less stable. For example, a possible problem with air mobile is that it can't launch the missiles from the ground, the planes have to take off. If in a severe crisis the planes took off as a precautionary measure, the Russians might wonder whether they were getting 10 minutes advance warning on a United States first strike and that could obviously have a destabilizing effect. There has already been some discussion as to whether United States and Soviet launch-under-attack systems in a crisis, when people start to wonder if they are going to go to war in the next hour or two, could have a destabilizing effect.

Finally, there are considerations of the stability of, I won't call it arms race, but reaction and counterreaction. Let me cite a couple of specific examples, to make this point clear. If we build MX-MPS the Russians have an incentive, they have a reason, to fractionate. Maybe they are going to fractionate anyway, no matter what we do. If they want to reopen the question, MPS gives them one additional reason to fractionate. Basing on submarines would give them an additional reason to work very hard on antisubmarine warfare. Air mobile basing would give them an additional reason to work on depressed trajectory attack from submarines against air bases and so forth. Basically we have to assume that no matter what we do the Russians are goind to try to respond. If we go to ABM they will try to build decoys.

It would be desirable from the point of view of stability if the Russian response was one which we were not particularly concerned about, rather than a Russian response which we think would create a lot of additional problems for us.

Now when you look at all those criteria, none of the systems, as Senator Mattingly said, are risk free. None of the systems, as Senator Garn said, are without very serious problems. You really have to take a look at what kind of problem you want to live with. That is not really a technical judgment but we hope that the technical information we have provided will help you gentlemen and help the Congress in general to make such judgments.

Mr. GIBBONS. Mr. Chairman, we have done an analysis of essentially all the ballistic missile defense options discussed today. If you would like to address us with further questions or technical questions from the staff we will be happy to respond.

Senator LAXALT. Very well.

Any additional questions?

DESTABILIZING EFFECT OF AIRCRAFT-MOUNTED MISSILES

Senator MATTINGLY. One real quick comment. You mentioned the aircraft taking off with the missiles on them would have a destabilizing effect.

Mr. SHARFMAN. It could have a destabilizing effect.

Senator MATTINGLY. Could not also the opposite be true, It would be a stabilizing effect also? You know it would be almost like the pea game with the MX. Having the aircraft take off would conceivably have a stabilizing effect on the decision of the Soviet Union also?

Mr. SHARFMAN. Yes, it could. That gets you into a time lag. If they take off and they become invulnerable, then the Russians should not do anything, but they will have to land. They will run out of fuel in 5 to 8 hours depending on the kind of airplane. When they land they are vulnerable. They have to refuel, and that in turn would be destabilizing.

Senator GARN. You would not plan on them all going up and flying and all coming back at the same time.

Mr. SHARFMAN. You would be rotating them and cycling them. You would be raising questions about how good Soviet intelligence was about tracking a lot of airplanes and where they were and what they were doing. It is not an easy job for the Soviets to carry out. After a couple of days of that you would have longer times on the ground for maintenance. It gets very rapidly into an operational kind of problem that you can't really settle on the back of an envelope.

Senator MATTINGLY. It also impact political decision by the opposition

Mr. SHARFMAN. Yes, sir.

Mr. GIBBONS. I can't help but share a quote with you.

Senator MATTINGLY. No Peanut's quote?

Mr. GIBBONS. No, I love Peanuts. This is from Paol Anderson who said, "I have yet to see any problem, however complicated, which once you looked at it the right way did not become still more complicated."

Senator LAXALT. That says is all. On behalf of the subcommittee I want to thank you very much. You have done a comprehensive job. You have been most helpful. Stay in touch with us. We will need you in the future.

HEARING RECESS

We We will stand in recess until 1:30 this afternoon when we will receive testimony from the Army Ballistic Missile Defense.

[Whereupon, at 12:10 p.m., the subcommittee was recessed to reconvene at 1:30 p.m. the same day.]

[Afternoon Session, 1:30 P.M., Thursday, June 18, 1981]

DEPARTMENT OF DEFENSE

Department of the Army

STATEMENT OF WILLIAM A. DAVIS, JR., DEPUTY PROGRAM MANAGER, BALLISTIC MISSILE DEFENSE, PROGRAM OFFICE, DEPARTMENT OF THE ARMY

ACCOMPANIED BY MR. JACK KALISH, DIRECTOR, BMD PROGRAM OFFICE, DOA

BALLISTIC MISSILE DEFENSE PROGRAM

Senator **Laxalt**. The subcommittees will come to order.

As we contine with our MX basing mode hearings, we will now hear from the Army concerning the ballistic missile defense program at it applies to MX basing options.

We want to welcome our witnesses, William A. Davis, Jr., Deputy Program Manager for Ballistic Missile Defense; and Jack Kalish, Director of the BMD Program Office.

Following these gentlemen's testimony we will receive testimony from Mr Lee Carpenter, an outside witness, who will discuss prompt counterforce, distruptive ABM and road mobile reserve.

Mr. Davis or Mr. Kalish, you may proceed in whatever order you would like.

Mr. **Davis**. I would like to use some Vugraphs first and answer questions at the end, if that is all right.

Senator **Laxalt**. It is all right. It is all yours.

BALLISTIC MISSILE DEFENSE (BMD) PROGRAM BRIEFING OUTLINE

- **SYSTEM DESCRIPTIONS**
- **TECHNICAL ISSUES & PROGRESS**
- **PROGRAM SCHEDULES & COST**
- **MISSION DESCRIPTIONS & EFFECTIVENESS**

[CHART 1]

BMP OVERVIEW

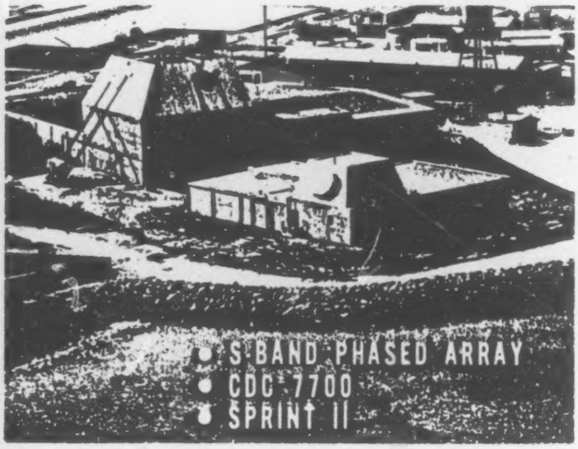
Mr. DAVIS. In order to give an overview of the ballistic missile program this afternoon, I want to touch on these four topics: First, describe the system we are working on in the research and development program, then to identify the technical issues as we see them and what progress we have made on them and what we are looking for in the future to resolve the issue.

Then I will touch briefly on some schedules and costs for the principal elements of the program, touching on a few budget problems that we still have. Finally, I will talk about the missions that these systems are good for, concentrating on defense of fixed and multiple protective structures, and identify the cost-effectiveness tradeoffs that we have analyzed for these systems thus far.

The first system I want to talk about is the most mature system that we have been working on for about 7 or 8 years now. It is the next generation beyond Safeguard. We originally called it site defense, now commonly called the baseline terminal defense system.

BASELINE TERMINAL DEFENSE

(SITE DEFENSE)



(DELETED)

(DELETED)

ATTRIBUTES

- DEMONSTRATED TECHNOLOGY
- FIXED SILO DEFENSE
- MULTI-SILO COVERAGE

[CHART 2]

BASELINE TERMINAL DEFENSE SYSTEM

The picture shows the site out at Kwajalein Missle Range in the Pacific, where we have built a prototype of this system and have been testing. We have just finished dedicated testing of this system this past September. I will talk more about that mission later.

The main components of Site Defense were an S-band phase radar [deleted] average power. It was driven by a big scientific computer, CDC–7700, and we envision the use of an upgraded version of the Safeguard Sprint interceptor that we call Sprint II. It had a performance of about [deleted] feet per second and boost velocity, with 4-second burning time, a very hot endoatmospheric interceptor.

We have not flown interceptors at Kwajalein since 1975 because of budget limitations. Sprint II is a paper design. We have been wringing out computer and software. These are in our view the greatest areas of technical risk in the Site-Defense concept. It was envisioned as a modular type of arrangement where we had multiple netted radars defending Minuteman, using radar command guidance.

It operated as shown on the little sketch on the right, with a search ceiling of about [deleted] feet in altitude. That is when we first detected the threat cloud. We committed to send interceptors at [deleted] feet. We intercepted between [deleted] feet.

Typically, from detection to intercept was about [deleted] seconds' time. We estimated that this system would have about [deleted] percent leakage; that is to say, about [deleted] percent of the reentry vehicles that we attempted to engage would penetrate or leak through the system.

To state it another way [deleted] percent effectiveness in engaging the RV's that were taken in to track. So the attributes of Site Defense, which we consider now as kind of an on-the-shelf system using demonstrated technology, are that it was for fixed Minuteman silos; it had multi-silo coverage; therefore, we were able to invoke preferential defense. This is implied by the intercept contour out here, which reaches [deleted] from the location of the interceptors and the radar.

We numerically could defend about [deleted] Minuteman silos per radar deployed.

Now turning to the next generation terminal defense system we call LoADS, or low altitude defense system, it has been tailored primarily for defense of multiple protective structures.

LOW ALTITUDE DEFENSE SYSTEM

[LoADS]

(DELETED)

ATTRIBUTES

- **SMALL, MOBILE**
- **LOW TECHNICAL RISK**
- **FIXED SILO OR MPS DEFENSE**
- **SINGLE SILO COVERAGE**

[CHART 3]

LOW ALTITUDE DEFENSE SYSTEM (LOADS)

The main reason we have gone to a smaller system—and this is about 6 feet in aperture for the radar—is so that it can be either concealed in trenches or horizontal shelters or vertical shelters or the like, to play the shell game with the defense as well as the offense.

It operates at S-band of [deleted] as contrasted to the [deleted] I mentioned before. We are going to a distributed data processing system with greater improvement in reliability, we think, over the 7000-series computer, and it uses a smaller single-stage interceptor capable of reaching [deleted] feet per second in a [deleted] again, a very hot interceptor.

It is designed primarily for mobile basing and uses inertial guidance with command updates. If we can use a nuclear warhead as envisioned with this system, we can come within [deleted] feet of the RV for a lethal radius. It operates at low altitude, under 50,000 feet, and intercepts at [deleted] feet.

The time here is compressed to [deleted] seconds. They were designing for a leakage of [deleted] percent, which is perfectly adequate for defending something like MX/MPS. We would prefer to have lower leakage if you are defending fixed silos, although this system does have utility for defending fixed silos it is not as well suited for that role as the old Site Defense system.

With the mobile LoADS we estimate that the risk entailed in building this system is low. We are engaged in a preprototype demonstration program now to build a system for test at the Kwajalein Missile Range including firing of interceptors. It is generic but, as I said, better in the role of MPS defense, because of its single silo coverage, than an fixed silo defense where we are faced with multi-silo coverage.

EXOATMOSPHERIC DEFENSE

(DELETED)

ATTRIBUTES

- **TECHNOLOGY NOT DEMONSTRATED**
- **MISSION VERSATILE**
- **BROAD AREA COVERAGE**
- **NON NUCLEAR KILL**

[CHART 4]

EXOATMOSPHERIC-TYPE BALLISTIC MISSILE DEFENSE

Now, to turn to exoatmospheric-type ballistic missile defense, we are talking about a different brand of BMD.

Instead of using large phased array radars placed on the ground as in Site Defense, and as we plan to do with LoADS, we are talking here about using optical sensors rather than radar sensors. The sensors are lofted either in probes or on interceptors up above in the atmosphere and in the midcourse regime of a ballistic missile trajectory.

The components that we envision for exoatmospheric-type of intercept system are the [deleted]. They survey the threat corridor for the ICBM's; they do the initial detection, tracking, coarse discriminination, and impact point prediction.

Based on those data, we launch interceptors. These interceptors have a D^3-detection, discrimination, and designation-sensor on board and they do fine-grain determination to separate the RV's from debris or tank breakup. Then they designate multiple nonnuclear kill vehicles to conduct the engagement.

In a sense, we are talking here about combating MIRV with MIRV. We are using multiple nonnuclear kill vehicles to gain leverage for the defense. We are talking here about fixed base, using optical homing guidance. We are operating above the atmosphere, above around 300,000 feet in altitude.

We start the game out at about [deleted] nautical miles, which gives us a lot of time compared to the other systems to do these functions—search, discrimination, commit and intercept.

The main problem with exoatmospheric BMD is that the technology has not yet been demonstrated. We have been working on the pieces of technology involved here, particularly LWIR sensors, since about 1969. I will show later some of or our field experience with these sensors; but we have not put it all together in a system context, in a prototype and tested it in the field, which would be required before you could deploy such a system. We are a [deleted] away from that.

It looks very promising. We think it is good, not only for defending ICBM sites but also for soft targets, time-dependent targets such as a SAC base and National Command Authority.

As indicated by the diagram, we will have a broad area coverage, cover a lot of geography per site. You have the very deep battle space and very importantly you are able for the first time to talk about nonnuclear kill. We do not have to use nuclear warheads. We think we can drive the miss distance down with passive optical homing sensors, so that we can effect nonnuclear kill either with a hit-to-kill type vehicle which we demonstrated several years ago in the HIT program, and the Air Force is now using for ASAT or the type we are using on the Homing Overlay Experiment (HOE), which we will test next year with a warhead on board these little multiple-kill vehicles.

Now, the final system I want to describe briefly is simply a combination of one of the terminal or underlay systems with the overlay to constitute layered defense.

LAYERED DEFENSE

(DELETED)

ATTRIBUTES

- **LOW LEAKAGE**
- **RESILIENT TO PEN AIDS**
- **DEFENDS AGAINST HEAVY THREATS**

[CHART 5]

LAYERED DEFENSE

Now, layered defense has a lot of the same attributes.

The main feature I want to point out, however, is that the leakage goes down dramatically, because the leakage of the entire system is the product of the overlay leakage and the underlay leakage.

If I can enforce [deleted] the total system leakage would be the product or around [deleted] percent. Anytime you have a defense mission which is not leakage tolerant, I want to minimize leakage, such as at a SAC base, for example, I would prefer to use a layered defense configuration. Ultimately, this concept can be extended to the consideration of space-based lasers, where I have [deleted] of intercept and still I would have the advantages of multiplying or compounding the leakages of each tier.

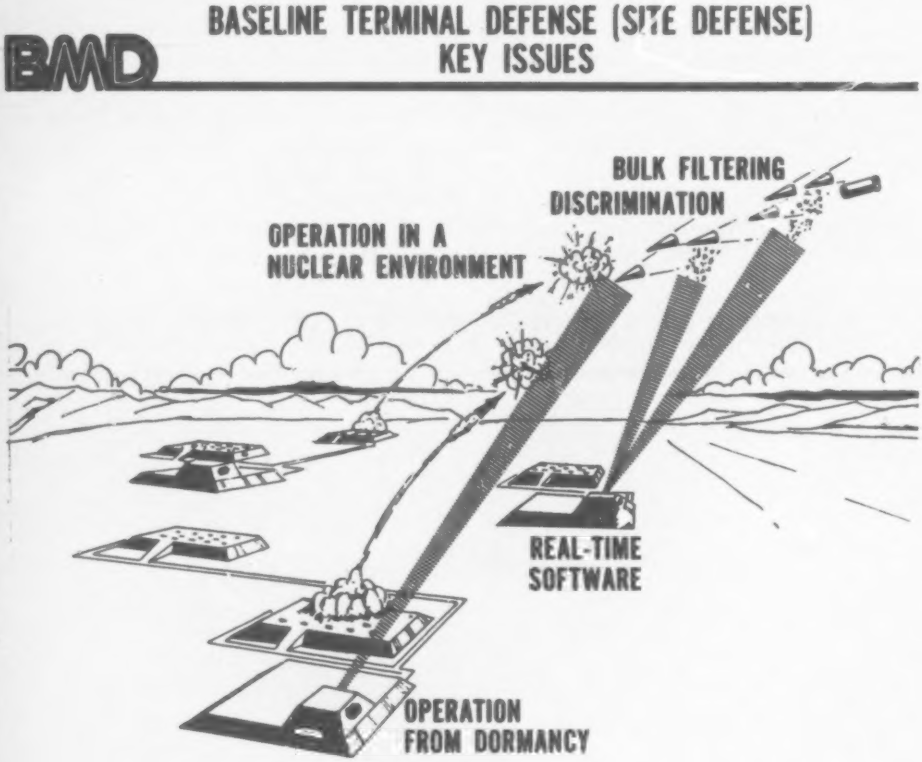
This system also is resilient to penetration aids, in that I have both radar and optical in the system. It is very difficult for a potential attacker to design a penetration aid, decoys, and so forth, that can penetrate both radar and optical sensors. Typically, what is good for one type of sensor is not good for the other.

This is a very robust type of system, in that it can stand off very large threats. We can absorb like on the order of 10,000 reentry vehicles, cost effectively, with this type of system, and I will show some numbers on that later.

Now we will talk about issues.

I have concentrated on the virtues of these systems. I want to try to give a balanced view of what the technical issues are, where we think we have learned how to resolve the issues and demonstrated that, and what we have yet to do.

Again, on the Site Defense we think that in the 7 or 8 years we have been working on this system, just finishing last September, that we have demonstrated that BMD will work for this type of system. There were a lot of deficiencies in Safeguard which we recognized when we designed the system. We think we have corrected them. We are very confident that these critical issues which were first identified in 1970 have been resolved.


BMD
BASELINE TERMINAL DEFENSE (SITE DEFENSE)
KEY ISSUES
BULK FILTERING
DISCRIMINATION
OPERATION IN A
NUCLEAR ENVIRONMENT
REAL-TIME
SOFTWARE
OPERATION
FROM DORMANCY

[CHART 6]

KEY ISSUES IN SITE DEFENSE

I won't try to go through these in detail, but will refer simply to the ability of the defense system to reject or kick out things like tank fragments or lightweight decoys, traffic decoys we call them, without the expenditure of a lot of time or energy from the defense system.

It turns out we found, much to our dismay, in the Safeguard test program that the [deleted] that have to be dealt with by the radar. [Deleted.] We had to learn and demonstrate that [deleted].

Discrimination—it used to be in the early days of BMD that we talked about "which twin has the Toni," how could you differentiate between a vehicle and decoy. It was the bugaboo of BMD in the early days. Safeguard did not have built into the software the ability to do decision discrimination. It was a bare-body system; it could only function against bare reentry vehicles.

With the Site Defense system we tested four or five different discrimination algorithms that are embedded in the software. We have demonstrated we can discriminate well enough, not perfectly, to make this kind of system cost-effective. That is to say, the leakage will not be excessive against decoys.

This is a very important contribution of our test program on this sytem.

Operation in nuclear environment you can never demonstrate, of course, but we have done simulation, and we have hardened the radar. Our estimate is that this kind of system can survive in the projected nuclear environment. We have cut on the radar from a cold state and demonstrated successful operation from dormancy. This kind of system is designed to operate unattended in the field.

Real-time software—we made real progress in comparison to Safeguard in developing and testing the software that goes with the system. It functions extremely well and with reliability.

SEPTEMBER 1980 BMD MISSION AT KWAJALEIN

(DELETED)

[CHART 7]

SITE DEFENSE TEST

This is an illustration of the last dedicated test that we had for Site Defense that occurred last September. This shows the Site Defense radar system; system technology radar is what the STR stands for. AT Meck Island at the Kwajalein Atoll we brought in a payload, lofted with a Minuteman I booster. The principal payload was [deleted] against primarily our Site Defense system, but we also in the same mission went up and got optical data with a Designating Optical Tracker, DOT.

Also on the same mission, the intelligence ship was on station. We had other range radars up for the mission also. We had our own recovery vehicle to pick up the DOT payload and to reuse it, and a Soviet trawler was on station, obtaining data, as it usually is.

It was a successful mission to wind up the testing out there and I will show some data later. This is [deleted]. We are now in the process of [deleted]. This shows before and after we recovered it at the lagoon at Kwajalein Missile Range.

—LOW ALTITUDE SYSTEM LoADS—

(CHART 8 DELETED)

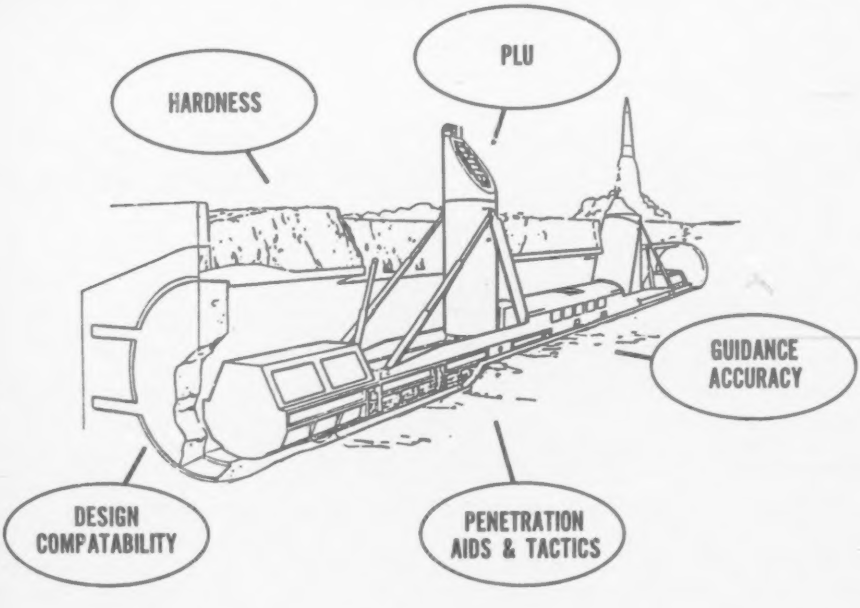
Turning now to the low-altitude system, I mentioned earlier that we view LoADS as low technical risk and that is true if you are talking about a deployment with fixed silos that are spaced no closer than about 5 miles apart.

In the application with MX, where the shelters are only about 1 mile apart, the requirements for nuclear hardness are very severe. We have to be able to survive a blast on an adjacent shelter. That drives us to an [deleted] radar. The best we have done in the past is [deleted] and corresponding radiation hardness requirements.

So this is a severe, stringent set of nuclear hardness requirements for the LoADS components.

BMD

LoADS TECHNICAL ISSUES



[CHART 9]

HARDNESS OF SILOS

I would emphasize hardness, I believe, in comparison with the other technical issues, which we think are somewhat less imposing technical demands on the system, such as preservation of location uncertainty; although obviously we cannot give away the location of the MX or we have given away the whole game.

EXOATMOSPHERIC DEVELOPMENT ISSUES

CAN YOU SEE IT?

- ABILITY OF ON-BOARD LWIR SENSORS TO PERFORM DETECTION, DISCRIMINATION, DESIGNATION (D^3) FUNCTIONS

CAN YOU GET CLOSE ENOUGH?

- ABILITY TO HOME-ON THE TARGET AND ACHIEVE MISS DISTANCES COMPATIBLE WITH NONNUCLEAR KILL

CAN YOU KILL IT?

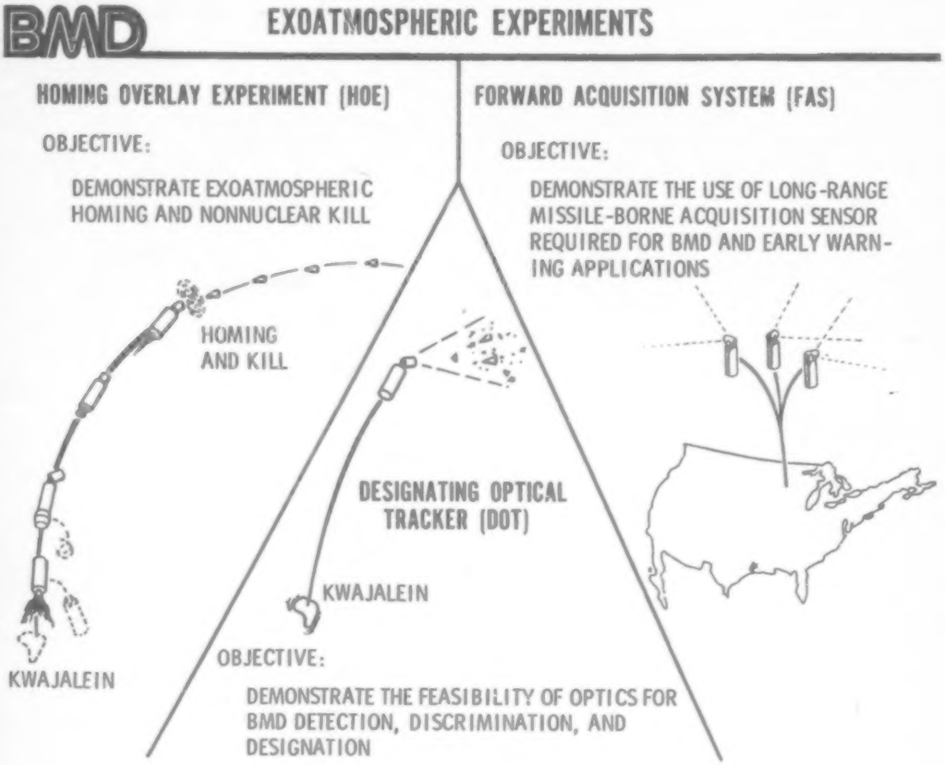
- ABILITY TO FUZE AND DEPLOY A NONNUCLEAR WARHEAD TO KILL A TARGET REENTRY VEHICLE WITH HIGH CONFIDENCE

[CHART 10]

EXOATMOSPHERIC DEFENSE

Now, in the exoatmospheric defense these express simple questions on the main issues. Can you see it? And, very importantly here, are these three words—detection, discrimination, and designation.

Can we discriminate exoatmospherically with passive optical sensors? There are three or four colors in the LWIR spectrum we use for discrimination. All our simulation results indicate yes, we can discriminate, we can differentiate between balloons, replica decoys and the like, with sufficient total confidence that we can enforce the kind of leakage that we need for the overlay, again not perfectly. This has yet to be proved. We have yet to acquire a large enough data base, as we have in the radar spectrum, to demonstrate that we can discriminate.


BMD
EXOATMOSPHERIC EXPERIMENTS
HOMING OVERLAY EXPERIMENT (HOE)
OBJECTIVE:
DEMONSTRATE EXOATMOSPHERIC HOMING AND NONNUCLEAR KILL
HOMING AND KILL
KWAJALEIN
FORWARD ACQUISITION SYSTEM (FAS)
OBJECTIVE:
DEMONSTRATE THE USE OF LONG-RANGE MISSILE-BORNE ACQUISITION SENSOR REQUIRED FOR BMD AND EARLY WARNING APPLICATIONS
DESIGNATING OPTICAL TRACKER (DOT)
KWAJALEIN
OBJECTIVE:
DEMONSTRATE THE FEASIBILITY OF OPTICS FOR BMD DETECTION, DISCRIMINATION, AND DESIGNATION

[CHART 11]

EXOATMOSPHERIC EXPERIMENTS

We have programs to demonstrate capability to discriminate. Another key technical issue that as of yet has not been completely resolved, can get close enough to do a non-nuclear kill?

Again, we have an experiment called Homing Overlay Experiment, under contract with Lockheed. The first flight will be next summer and we are planning to [deleted]. That embodies the third question, because we will have onboard in that vehicle the [deleted].

We have a series of these experiments. Let us talk about the Homing Overlay Experiment. There are four missions, starting next summer, to demonstrate that we can do, in fact, exoatmospheric nonnuclear kill. Another program has been ongoing for several years now called the Designated Optical Tracker; in it we are firing probes out of Kwajalein Missile Range. I showed one earlier in connection with the September mission. We are looking out with these long-wave infrared sensors, we are acquiring operational vehicles fired out of Vandenberg, gathering data and performing all the functions we need to do for the precommit functions of an overlay system.

The Forward Acquisition System is another name for the probe I showed you earlier; the probe that goes up in advance of the interceptor to acquire data on where the threat is going, and to do the coarse discrimination.

This is a ground test program as currently planned. We are building a large state-of-the-art sensor. We have just competitively awarded the contract for it. The forward acquisition sensor will be much more advanced over DOT or any other optical sensor we have built and capable of surveying and sorting out thousands of objects to act as a probe for overlay or layered defense system.

Along with that, we will build an onboard computer to do all the data processing. We will wring this out in ground testing. We think probably you can do all the testing that you need on the ground and in some cases you can do testing that you would not be able to do in actual flight test where you have large numbers of bodies.

—SEPTEMBER 1980 DOT MISSION—

(CHART 12 DELETED)

DOT DATA

This is just to illustrate briefly some of the data that we got from DOT last September. We got about 5 or 6 minutes of data as we tracked the payload cloud coming in. This shows the vehicle going up. We acquired in this particular case at [deleted] miles; these sensors can acquire much farther than that, these are sensitive devices. In this particular case we picked up the threat at [deleted].

In this case, we were trying to stress the sensor to see if it could [deleted].

—DETECTORS IN FOCAL PLANE OF SENSOR—

(CHART 13 DELETED)

[Deleted.] We were very pleased that we were able to see [deleted] as indicated by this little diagram which is an actual representation of the detectors in the focal plane of the sensor.

This is the [deleted]. This is the [deleted]. This is the [deleted]. The [deleted].

—ADJACENT DETECTOR—

(CHART 14 DELETED)

Again, this shows another view with an [deleted].

This is an adjacent detector, [deleted].

Last Friday we had another mission of DOT where, for the first time, we acquired the [deleted].

We are progressively increasing the degree of sophistication in the technical objective as we go along. It is beginning to lend confidence now that we can use these kinds of optical sensors not only for BMD but also the spinoff mission that I want to show an illustration of with the next Vugraph.

This is a kind of spinoff mission for the BMD program for augmentation for the tactical warning/attack assessment capability. We have proposed this as a capability which really has nothing directly to do with ABM and therefore nothing to do with the ABM treaty.

The concept for which Senator Domenici and you, I believe, Senator Laxalt, and others, cosponsored an amendment to add money to the 1982 authorization bill to build these probes by [deleted] that could go up and do a scan of the whole ICBM threat corridor and reach out a couple thousand miles and do impact point prediction and make a contribution toward surviving forward acquisition systems. We call the concept survivable optical forward acquisitions system, SOFAS.

—SOFAS PROBE OPERATION—

TACTICAL WARNING AND ATTACK ASSESSEMENT

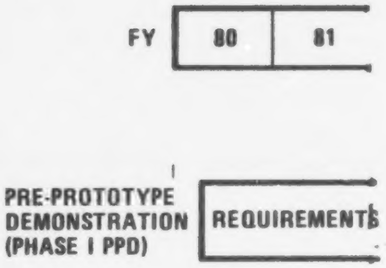
(Chart 15 Deleted)

If the SOFAS program goes through, we will be developing these, [deleted]. We are considering using either Spartan boosters or Minuteman or Poseidons.

The boosters are not important, but we want to use the available hardware to keep the cost down. The total cost, as we said before, is $600 million.

Now I want to talk a little bit about schedules and budgets.

LoAD PRE-PROTOTYPE DEMONSTRATION PROGRAM



(DELETED)

(DELETED)

PHASE 1
PRE-PROTOTYPE
DEMONSTRATION
COSTS *

FY	80	81
TOTAL	20	90
RDT&E	20	90
MCA		

(DELETED)

[CHART 16]

LOAD PREPROTOTYPE DEMONSTRATION

This is the schedule we have laid out for the LoAD preprototype demonstration. I won't try to go through all of this. I simply want to point out to you that we accelerated the schedule last year. We were on a pay slip, which put us out to completion about [deleted]. Now, we have accelerated that by 2 years, so that we complete that demonstration by [deleted] and we can reach an IOC by [deleted] and an FOC by [deleted] a more compatible schedule.

Unfortunately, recently our supplemental request of $36.2 million for this acceleration was deleted in the Joint Conference of the Appropriations Committee. That brought this figure down to around 54. We were hoping that we could get an amendment on the House side to add that back in 1982. If we can do that, we think we can still complete the schedule, finish prototyping by [deleted].

This is a problem and an uncertainty now. We have geared up to accelerate and now we are slowing down. We hope to regain the momentum in 1982.

—OVERLAY DEMONSTRATION—

PROGRAM ACCELERATED SCHEDULE (U)

(Chart 17 Deleted)

This is a very busy Vugraph. I won't try to address all the details on here. I simply want to point out that for the exoatmosphere overlay type technology, what we would like to do is get on a schedule that will allow us to go into engineering development, full-scale development authority to proceed in [deleted].

We are not on that schedule now. This program is funded below threshold for that kind of schedule and I will show you in just a minute what we thing we need to do to get on that base. If we can do that, we can realize an [deleted].

—OVERLAY PROGRAM OPTIONS—

(Chart 18 Deleted)

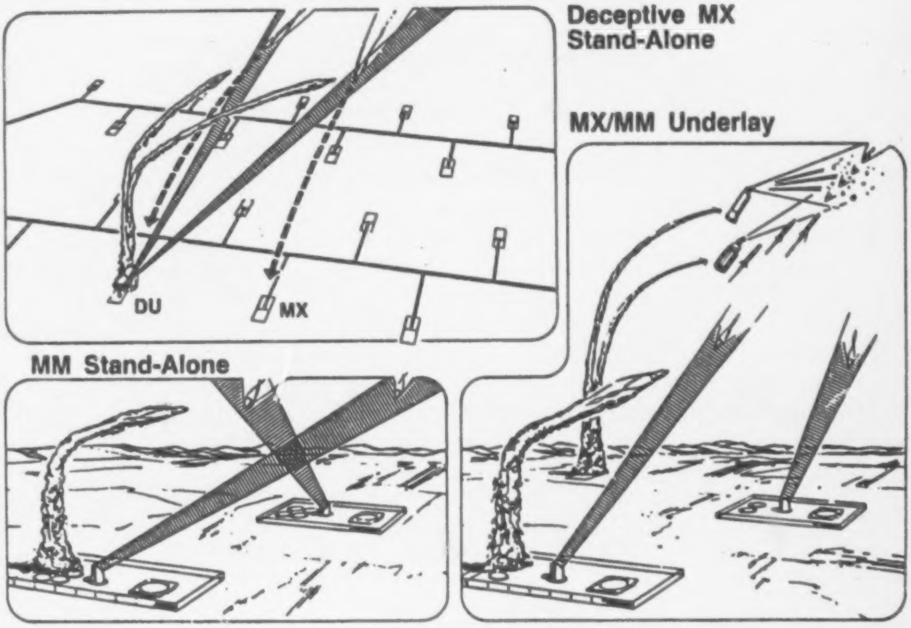
I don't know if this shows up too well, but this is an attempt to show the problem that we have with exoatmospheric funding profile now. You will notice in the background these are the dollars that we are now expending on exoatmospheric technology. This includes all the elements of the program I have been talking about, in an amount over this whole period here of [deleted].

The problem of this kind of technology program is that it does not allow us to project an IOC date in the foreseeable future. We think we need this kind of infusion of dollars shown in red in order to get on track for a deployment program or a program that will allow us to confidently predict [deleted].

This is a total of about $350 million over this 4-year period.

Now, in this last section of my remarks this afternoon I am going to attempt to talk about cost-effectiveness, what are these systems good for, what roles, what missions, where are they strong, where are they weak, and what is the cost and what is the crossover point in terms of the number of RV's that they can cope with in a threat?

LOW ALTITUDE DEFENSE APPLICATIONS



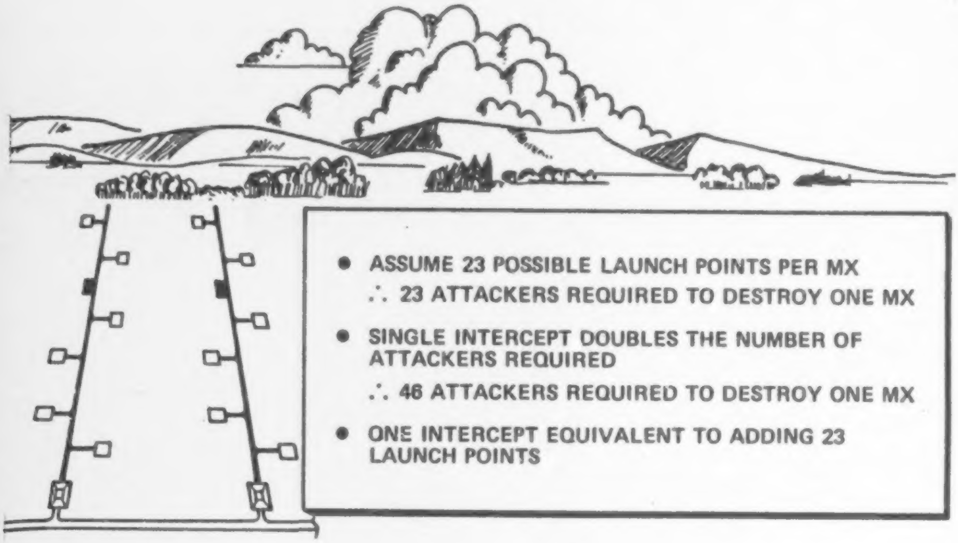
[CHART 19]

LOW ALTITUDE SYSTEM

The low altitude system, as I have talked about, we are attempting to design for a generic capability so that it can serve as a Minuteman stand-alone system; it can work with MX as indicated up here, or it can serve as an underlay to the overlay for a layered defense configuration.

Now, with a deceptive basing scheme such as MX/MPS, we get the maximum leverage we have analyzed for any ABM role. It is simple because we exploit the shell game leverage built into the offensive basing.

MX DEFENSE DOUBLES ATTACK REQUIREMENTS



- ASSUME 23 POSSIBLE LAUNCH POINTS PER MX
  ∴ 23 ATTACKERS REQUIRED TO DESTROY ONE MX
- SINGLE INTERCEPT DOUBLES THE NUMBER OF ATTACKERS REQUIRED
  ∴ 46 ATTACKERS REQUIRED TO DESTROY ONE MX
- ONE INTERCEPT EQUIVALENT TO ADDING 23 LAUNCH POINTS

[Chart 20]

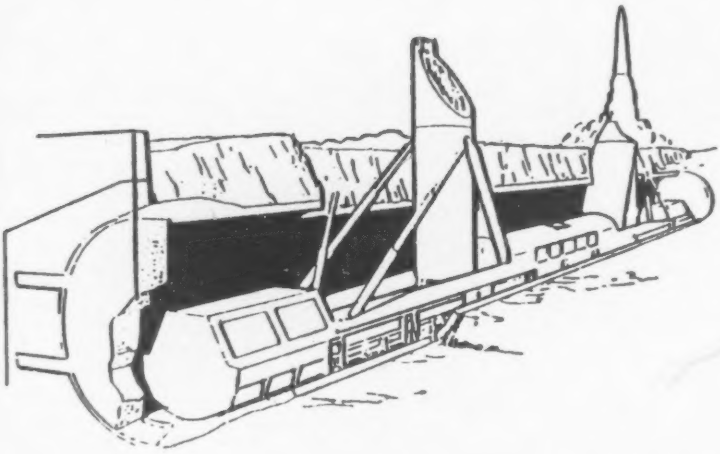
BEAN COUNTING FOR BMD

This simply shows how the bean counting is done for this kind of BMD. If you have 23 aim points per MX and you add a BMD system somewhere in these 23 shelters and it engages preferentially only the reentry vehicle aimed at the MX, then it has doubled the attack price required to take out the MX from 23 RV's to 46 RV's.

One BMD intercept then is equivalent to adding 23 additional shelters.

LoAD DEPLOYMENT WITH MX - MPS

(DELETED)



[CHART 21]

MX/MPS—BASED LOAD

This is a layout then of how we would use LoAD based with MX/MPS. This is a cutaway which shows the LoAD radar and data processor and a canister of interceptors which would be parked in one of the shelters.

As indicated by these footprints, this is a typical valley of 10 clusters of 23 shelters each. The footprint indicates that the defense unit can be decoupled from the location of the MX. This is to say this covers about 20 shelters so that we don't have to be located adjacent to the MX. So we have total coverage and in many cases overlapping coverage in the entire valley.

They are parked in one of the existing unmodified shelters.

With that mode of operation, we can enforce this kind of improvement in survivability. This drawdown curve is plotted for a combination of 1,000 Minuteman silos and 200 MX with 4,600 shelters. This is the number of survivors versus the attack size. You come down to this kind of survivor level, crossing over [deleted] RV's surviving here, something in [deleted] of 4,000 RV's.

If you add LoAD with MPS it pushes the survivor level out, as indicated by the dashed line.

The cost of the LoAD is on the order of $7 billion. Here is the only place we can talk about cost of this order, $7 billion, and with a small number of interceptors. Only about 600. With these 200 defense units we would have three interceptors defense unit, for a total of 600 interceptors.

—BASELINE TERMINAL DEFENSE (SITE DEFENSE)—

(Chart 22 Deleted)

The other costs we talk about, Site Defense and Layered run more in the order of $20 to $30 billion. This is a little background of Site Defense deployment for Minuteman silos. It is 1,000 Minuteman silos.

The radars are laid out as shown by the squares; triangles are interceptors; dark circles are Minuteman silos. We can enforce this drawdown curve for improved site defense. We superimpose a deployment of 2,850 interceptors and 133 radars. We cost it close to $21 billion. It can give you this kind of improvement in survivability.

You will notice a long tail driving the threat size to about [deleted] or [deleted] RV's before you come all the way down to zero survivability. If you desire [deleted] survivors, the crossover would come between [deleted] RV's.

Now you have overlayed on here a curve that shows the effect of adding 200 MX's in fixed Minuteman silos along with 800 Minutemans. The equivalent survivors are shown on the right-hand scale. As you can see, we elevated the number of survivor levels for a given threat size out to around [deleted] and with additional investment in defense you can raise it up farther.

This is the basic kind of cost-effectiveness built into a site defense system using preferential defense, more or less conventional netted radars, and Sprint II interceptors.

—LAYERED DEFENSE SYSTEM—

(Chart 23 Deleted)

Now, if you will look at layered defense and contrast the undefended drawdown curve here for a mixture of 200 MX missiles in Minuteman silos with 800 Minutemans, then I can get this kind of cost-effectiveness. If you remember, the previous drawdown curve showed a smaller survival level; here the crossover is [deleted] surviving RV's with [deleted] Soviet RV's, with a total system cost as shown.

We realize this improved cost-effectiveness with layered defense, for defending fixed silos because we take advantage of multiple nonnuclear vehicles, giving the low cost per intercept, low leakage, and an adaptive preferential defense. We can implement adaptive strategy because the probe tells us where everything is going.

—COMBINED SYSTEM DEPLOYMENT—

(Chart 24 Deleted)

I want to show one combination here for a case where I start with the same curves here I showed before for LoAD defending MX/MPS. If you want to extend the survival level further, another possibility would combine LoADs with MX/MPS with overlay of the residual 800 Minutemans; that would give you a survivability crossing over the [deleted] survivor level at around [deleted] RV's, for a total cost as indicated.

Finally, I want to talk a little bit about stability considerations, how BMD figures in the concept of stability.

It is a little difficult to define what stability is, and I am not going to attempt that rigorously here, but I want to try to indicate how BMD can contribute to a perceived stability.

STABILITY ASSESSMENT WITH MX/MPS

(UNCONSTRAINED THREAT)

(Deleted)	• **U.S.S.R. FIRST STRIKE**
(Deleted)	• **1990 BEST ESTIMATE UNCONSTRAINED THREAT**
(Deleted)	• **200 MX, 6900 SHELTERS + 800 MM**

[Chart 25]

[Deleted.]

If you have LoAD, that shifts the curve out to the right, that is more U.S. survivors. If you had the combination case of LoAD, plus [deleted] overlay intercept force, you can drive it further to the right. [Deleted.]

With different forms of BMD we think these are potential contributions to strategic stability, coupled with the offense deployment.

That concludes the formal remarks I have.

Mr. Kalish and I will be prepared to answer questions if you want to go into it further.

Senator **Laxalt**. Since much of this material is highly technical in nature, we have Joe Mayer of Senator Garn's staff to proceed with some technical questions, so we will have a bit more adequate record, if that is acceptable to you gentlemen.

Mr. **Mayer**. I am going to try to move quickly through these things. It might be repeating some things, but I think with layered defense redundancy may be a virtue in that regard.

AMB SITE DEFENSE U.S. SAFEGUARD SYSTEM

Do the components of a Site Defense ABM system differ significantly from those used in the Safeguard system? Is that to our advantage if they don't, and how is this different from the LoAD system?

Mr. **Davis**. Comparing Site Defense components with Safeguard?

Mr. **Mayer**. Yes.

Mr. **Davis**. There is a considerable difference. You may recall Safeguard was composed of four main parts: Spartan interceptors which used the [deleted] warhead; Sprint interceptors, which used a [deleted] warheads and operated in the endoatmosphere; the missile site radar, MSR, which is a large S-band phased radar; and the PAR radar, which is a big UHF radar. As you probably know, PAR radar is now the PARCS radar and is still operational out at Grand Forks, used in early warning. As we transitioned from Safeguard to Site Defense, we wanted to correct all the deficiencies we were aware of and upgrade the technology of Safeguard. So we went, for example, from specialized military computers, so-called CLC, combined logic computer, designed and built by Western Electric BTL, to the commercial 7700 computer which not only was cheaper but also was commercially available, but also had greater throughput capability and greater inherent reliability.

We went to a different form of software engineering to try to get cheaper and more reliable software for the Site Defense system.

We went to netted radars so that we would not be vulnerable to blackout, as MSR was. Across the board we used upgraded electronic equipment. For example, the phase shifters on the MSR at the Kwajalein Missile Range, are several feet long and they are inherently unreliable; with Site Defense we went to the small ferrite phase shifters. We upgraded across the board electronically in Site Defense. Comparing Safeguard and site defense is kind of like comparing a Cadillac and a Model T; however Safeguard was a technological achievement for the time frame.

SYSTEM CONSISTENCY

Mr. **Mayer**. Is there a consistency in terms it is an upgrading, but is there an advantage in the consistency from a Safeguard system to Site Defense in terms of upgrading components?

Mr. **Davis**. How do you mean, consistency?

Mr. **Kalish**. For example, the Sprint interceptor was designed for the Safeguard system and the Sprint II was a direct follow-on in improvement of virtually the same airframe. The radars were at the same frequency and we found that the Site Defense radar did not need all the power that the Safeguard did.

So we bootstraped our way in that fashion by building on the previous technology. Is that what you mean?

SITE DEFENSE SYSTEM

Mr. **Mayer**. Yes. What advantages did the Site Defense system have over LoAD in terms of defending vertical ICBM's in silos?

Mr. **Davis**. Site Defense was optimized, at least the intention was to optimize the design for defending Minuteman. In order to do that, we went to multiple silo coverage.

The deployment ratio, we call it, the number of silos per radar, was about 7 to 1. With that kind of coverage you could get preferential leverage. You could use preferential defense leverage. You could intentionally and a priori decide to defend some targets and not to defend others and therefore realize leverage.

LoAD is a single silo defense system. It takes one radar for every Minuteman silo. So you can't get preferential leverage.

Furthermore, with Site Defense we had high altitude to start the search and more battle space in altitude in time so that we could use shoot-fail shoot techniques. If an interceptor failed to kill a reentry vehicle at the upper boundary, we could replace that and get the same RV. We invoke those kinds of techniques for Site Defense which optimize it for Minuteman defense or fixed-site defense, whereas, LoAD does not have all that leverage and is more effective for MPS.

VARIED USE OF INTERCEPTORS

Mr. **Mayer**. Could you use multiple interceptors with Site Defense interceptors? I know we are moving into areas that contradict the ABM treaty terms. Putting that aside, does the Site Defense interceptor have the capability to have multiple launchers; is that an advantage?

Mr. **Davis**. I don't think so, that we can do that. The Sprint II interceptor was almost twice as large as the LoAD interceptor. So it is a physical problem more than anything else. We certainly couldn't get the Sprint interceptor concealed in an MX shelter; it is too large.

I don't think there would be an advantage of clustering the Sprint-class interceptors.

The thing we really prefer to do, of course, when we go into overlay-type technology, is to use multiple nonnuclear kill vehicles.

NONMOBILE SITE DEFENSE ABM SYSTEMS

Mr. **Mayer**. Would the decision to enter into engineering development for nonmobile Site Defense ABM systems constitute a violation of the ABM treaty?

Mr. **Davis**. Not if you restricted that to one site. The treaty originally set two sites and if you stayed within the quantitative limitations of 18 small radars, two large radars, and 100 interceptors, you could deploy; a subsequent protocol cut the allowed number of sites to one.

The Soviets continue to operate the system at Moscow which is within the limits of the treaty and we can do the same thing.

We closed down the Safeguard by direction of the Congress in 1976. We have not seen fit to go back and recommission the site, but we could do that with Site Defense within those limits.

Senator ANDREWS. If you went back to looking at ABM, would you go back to the Safeguard site?

Mr. DAVIS. It depends on the resources you are defending. That is a good location from a lot of points of view. It is in the middle of the threat corridor. From our point of view, this would be a good location.

Of course, if we were deploying MX in the Southwest or somewhere else, you would have to relocate those resources to defend it. We could go back and defend the Minuteman at the Grand Forks site.

NONTREATY SYSTEMS

Senator ANDREWS. What you showed us essentially in these graphs was not a system or a series of systems that would be allowed under the SALT agreement?

Mr. DAVIS. That is correct.

Senator ANDREWS. You showed us, as I understand, the thing popped up in the sky and it was unlimited or certainly not limited to 100 missiles backing them up?

Mr. DAVIS. That is correct. Virtually everything I showed was showing results of studies or deployments that far exceed the limits of the treaty.

Senator ANDREWS. When you mentioned previously you would take out this LoAD, I got lost. One of them, you said, you deploy at Grand Forks. That was not meaning you would deploy it at the Safeguard site?

REUSE OF GRAND FORKS SITES

Mr. DAVIS. We probably would want to; if we ever went back to Grand Forks, we probably would want to make use of those facilities as much as possible. We still have holes in the ground up there where the Spartan/Sprint interceptors were located.

Senator ANDREWS. You are moving all the housing out of there; better put a hold on that if you are going to move back in, because that is expensive to rebuild.

Mr. DAVIS. That is true. We went back up there last year and looked at some of those Spartan cells, to see if they were useful. They have remained in fairly decent condition. We would want to use those existing facilities to the maximum extent possible.

Yes, I think we would go back to the same site if we end up with a deployment within the limits of the tready.

Senator ANDREWS. You are tearing down all the personnel housing up there right now. I just point that out because the chairman would be interested in that. It is costing you more to move, really, some of that housing than it would cost to build new housing where it is. In effect, you are getting absolutely zilch for zilch. You are moving it out of that area and relocating it.

You could build new housing down at Grand Forks which is where you are moving to. If you think about doing anything soon, somebody ought to start getting a little smart.

Thank you, Mr. Chairman.

IOC DATE FOR SITE DEFENSE

Mr. **Mayer.** Assuming President Reagan were to announce an MX basing scheme that involves ABM defense as an integral component and not merely as a hedge to future threat, what IOC date could be achieved for Site Defense?

Mr. **Davis.** You are talking about LoADS?

Mr. **Mayer.** Site Defense of MX and employed in Minuteman silos.

Mr. **Davis.** We have looked at that. I think I would rather furnish you a date for the record rather than to try to recall it from memory.

Mr. **Mayer.** Does [deleted] sound right?

Mr. **Davis.** I think [deleted] is a little pushy for Site Defense. Although I emphasize that is a demonstrated technology, which it is, there are things like the fact that the CDC-7700 computer that we used is somewhat obsolescent now, and we would probably rather have integrated circuits and we would have to investigate the availability of the quantities required of LSI technology for the 7700.

Then we would have to build for the first time the Sprint II interceptor.

As I mentioned, they never were built or flown, so we would have leadtime on that. I think they would be in the neighborhood of [deleted] but I would like to substantitate that for the record and get you a better time estimate.

Mr. **Mayer.** Could you develop such a system under the terms of the treaty?

Mr. **Davis.** We could develop it, but we would have the same problems, same limitation on deployment.

Mr. **Mayer.** When would decision have to be made to amend or withdraw from the treaty?

Mr. **Davis.** Unlike the LoAD system, where we have a problem with the mobility provision of the treaty, prohibition of mobility, I don't think you would encounter a treaty problem on Site Defense until you started exceeding the quantitative limits of the treaty.

Mr. **Mayer.** So we could go, for instance, to [deleted] and not have to break out or amend the treaty and still be developing the capability?

Mr. **Davis.** We could do all the development; you could do the testing at Kwajalein. As you know, the Soviets are [deleted]. There is no prohibition there.

DEPLOYMENT OF MX SYSTEMS

Mr. **Mayer.** Assuming the requirement for [deleted] surviving warheads and given a decision to employ MX in Minuteman fields defended by a Site Defense system, would there be any advantage in digging additional silos which could also accommodate MX, and also would there be any advantage deploying more than 200 MX systems, say 250 or 300?

Mr. **Davis.** Yes. That helps the job of defense. The larger the number of ICBM's or, more specifically, the larger number of RV's, that are under the defensive umbrella, the easier it is for defense to assure certain survival levels, as I showed with drawdown curves for Site Defense.

Furthermore, it always helps defense to have deceptive basing. So the larger number of shelters that are unoccupied would help the defense also.

I can't quantify that offhand, but we could if you gave us specific numbers.

Mr. MAYER. If the United States were interested in getting back into the business of ABM, but we were not yet prepared to abandon or amend the ABM treaty, would it be preferable to reactivate the Safeguard system to employ limited Site Defense.

Mr. DAVIS. Site Defense by all means. We would never want to retrogress to the Safeguard technology.

Mr. MAYER. What advantages exist for employing a Site Defense system under terms of the ABM treaty with respect to any subsequent action or decision to employ a more formidable task or decision to move beyond that to amend the treaty?

Mr. DAVIS. It allows us to get industrial base cranked up, to get production lines going, to get back in the business of where we were in the Safeguard deployment era which had a lot of leadtime associated with that. A treaty-limited deployment is not effective by itself in assuring certain survival of it. It would have those advantages in getting cranked up and enable us to extend the employment rapidly.

ENHANCEMENT OF EARLY WARNING SYSTEM

Mr. MAYER. In your opinion, would the United States be advised to enhance its early warning system particularly with respect to the survivability of our existing assets in a nuclear war scenario?

Mr. DAVIS. I don't think we are the right people to answer that question comprehensively on the early warning capability.

Our modest contribution, we think, to possible enhancement has been the SOFAS idea, which was the subject of the Senate amendment in the 1982 authorization bill. We think that inherent in that technology is a good spinoff capability for that role.

It is survivable. It gives you extremely good impact point prediction. You can tell within a few miles where all the RV's are headed.

We think that could augment the existing system, but we really have not done an assessment.

Mr. KALISH. We always have requirements for a survivable early warning system; so it is necessary for ballistic missile defense.

Mr. MAYER. I have two examples I would like to submit for the record in terms of various threat levels and what that would entail in terms of ABM defense.

DATA BASE FOR SITE DEFENSE RV DISCRIMINATION CAPABILITY

Do you have a good data base for Site Defense RV discrimination capability?

Mr. DAVIS. Very extensive data base on discrimination, largely a S-band frequency.

Using not only the Site Defense radar at Kwajalein but also the dish radars up at Roi Namur Kwajalein Missile Range, as I tried to indicate, when I was talking about the issue of discrimination associated with Site Defense, we are very confident now, I think we have a consensus in the scientific community, that we can discriminate well enough with a terminal defense system to enforce the kind of probability of false alarm and probability of leakage, not to get too much in the technical jargon, but the basic parameters of the effectiveness of terminal defense system against a threat that contains decoys.

We feel that it is not to the attacker's advantage to use part of his payload for decoys, precision decoys. Our numbers indicate he [deleted]. [Deleted.] That has been demonstrated in live tests insofar as we have been able to do it at Kwajalein.

EXOATMOSPHERIC CAPABILITY

Mr. MAYER. I have a few questions about the exoatmospheric capability. If a decision were made next month to deploy MX in Minuteman silos with a protective system with layered defense, what IOC dates could be achieved in a homing, layered defense?

Mr. DAVIS. That would be [deleted] depending on the total number of overlay interceptors deployed.

Mr. MAYER. Then there is no problem immediately leading to breakout of the treaty or we could wait until at least [deleted] before we made any final decision about amending or withdrawing from the ABM treaty? Would that kind of decision hurt those IOC dates?

Mr. DAVIS. No. There is no treaty decision required. There is nothing we would do in an overlay or exoatmosphere technology R. & D. program that violates the treaty.

Mr. KALISH. I think the treaty violation probably would come up when we started developing a multiple interceptor. That would be the first indication that we would have a problem.

Mr. DAVIS. There is a clause in the treaty that prohibits the use of multiple kill vehicles or interceptors.

Mr. MAYER. When would you assume that problem would be here?

Mr. DAVIS. That would be probably in the later stages of research and development. I would estimate sometime in the [deleted] before we would need——

Mr. MAYER. [Deleted] is no problem?

Mr. DAVIS. No, sir.

SOVIET MARV THREAT

Mr. MAYER. How serious do you consider the Soviet MARV threat?

Mr. DAVIS. We think it would be a serious threat to BMD. MARV is a very difficult target for BMD. The way we would react to MARV if we were to see intelligence indicators on it would be, first of all, to plan to intercept exoatmospherically. We would prefer to combat MARV with the overlay type of technology or exoatmosphere, where we intercept before the reentry vehicle enters the atmosphere and starts to maneuver.

That has a penalty of losing some of the preferential leverage, but it does give you capability to achieve intercepts.

Beyond that, if you were dual, with MARV, with terminal interceptor versus MARV, we demonstrated with the Upstage technology years ago that you can achieve that, but it gets very demanding on technology.

You have to have the lateral G capability, as we demonstrated units Upstage of upward of [deleted] and it is very challenging and very costly.

ABM DEFENSE OF ICBM SILOS

Mr. MAYER. Does discrimination in RV kill capability in the exoatmosphere ABM system need to be 100 percent in order to have a desirable ABM defense of ICBM silos?

Mr. DAVIS. The kind of numbers I used in the briefing, of [deleted] percent leakage, is allowable where you are defending silos, if that is the sense of your question. You can tolerate leakages on that order and still satisfy defense objectives, like saving [deleted] which is a typical number used out of the total deployed force.

Now, leakages are less tolerable for other defense missions, like SAC bases or cities. You don't want one leaker; it is more difficult to enforce leakage requirements.

For ICBM defense where you are only trying to save a fraction of the force, you can tolerate leakage.

FEASIBILITY AND SURVIVABILITY OF SYSTEM

Mr. MAYER. In terms of bottom line for ABM defense of MX deployed in silos, do you agree with the OTA assessment that that is not a feasible and survivable system?

Mr. DAVIS. No, we do not agree with that finding. I did not hear the presentation that I understand was made this morning, but we have had access to, I think, the essence of the report of the OTA and it is more negative on the ability to do optical discrimination than we estimate. We are very confident that we can demonstrate the capability to you of the required optical discrimination and perform the other functions required.

We have been corroborated in that assessment by outside Defense Science Board groups such as Mr. Augustine's group that reviewed the program last year, and other such reviewers.

As I have tried to indicate, it is not a trivial problem; it is difficult. We think with the advanced sensors that are emerging in the 1980's—multicolors, high resolution, very good sensitivity—that we can do it.

APPROACH TO MX BASING

Mr. MAYER. I have one question we discussed this morning—a potentially disruptive ABM system and its implications for Soviet strategic planning of a first strike against the United States. I would like you to consider the merits of a situation I am going to outline and the possible time frame in which it could be ready to be deployed:

First, if the United States were to make a decision to deploy an additional 5,000 PSI silos in the Minuteman field and locate these silos approximately 3,000 feet apart, and these silos would, in my opinion, be sufficient to accommodate 200 to 250 MX missiles and one would assume that the closeness of the silos would significantly increase the problem the Soviet RV would have in terms of fratricide. In addition, the United States would add to the Soviet problem by deploying an exoatmospheric disruptive ABM system. And, finally, the United States would deploy preferential-type defense to intercept the Soviet RV's which are not destroyed by the exotmospheric defense system.

Do you have any comment about that kind of an approach to MX basing?

Mr. DAVIS. We have not studied that part of it adequately to give a competent answer.

I just heard yesterday the Foreign Technology Division briefing—Wright-Patterson people—on what you call disruptive types of ABM systems. It appears to me, being based on a cursory look, that it does have merit for cases where you have the targets closely spaced, such as MX/MPS which are only 1 mile apart, or even closer in the example you cited.

[Deleted.]

We really have not studied that adequately. Beyond that, the second part of your concept, I think it would be required to give a high degree of assurance of survivability. That is the underlay. I think you would still want to be sure that you can enforce a certain survivability level by having underlay and not depending exclusively on deflecting RV's atmospherically. It is a combination which has some merit.

Mr MAYER. I have no more questions.

Senator LAXALT. Senator Garn?

SOVIET DEVELOPMENT OF ABM CAPABILITY DURING TREATY

Senator GARN. Have the Soviets been active in developing ABM capability since we signed the treaty in 1972?

Mr. DAVIS. Yes, sir. [Deleted.] We work hand in glove with the Missile Intelligence Agency at Huntsville. They have been outspending us, we think. They have been doing things such as continuing to [deleted]. They have continued to maintain the system at Moscow, as you know, operational; so they have continued to gain operational experience with ABM systems that we have not had.

Senator GARN. They have been testing their [deleted] I believe?

Mr. DAVIS. That was a [deleted].

Senator GARN. They don't consider it a violation. When we usually call them on it, they either stop doing what they were doing or say that was not the understanding of the treaty. Anytime we have had enough nerve to call them, which has not been very often, they say, "Oh, we are sorry; we didn't understand it that way."

It is my understanding [deleted].

Mr. DAVIS. Yes, sir, we are very much aware of that.

We are concerned about it. There has been some controversy in the community as to [deleted].

Senator GARN. Have they tested their [deleted].

Mr. DAVIS. [Deleted.]

Senator GARN. [Deleted.]

Mr. DAVIS. [Deleted.]

Senator GARN. [Deleted.]

Mr. DAVIS. Yes, sir.

Senator GARN. Is there any indication that [deleted] have aided Soviet development of the ABM system?

Mr. DAVIS. I don't think we can cite directly examples that we can prove. We were concerned very much several years ago about the [deleted]. I don't think that that was ever agreed to.

We were more concerned about [deleted] than we were, say, for example, [deleted] where we don't think it would be as meaningful because, in our net technical assessment we always felt we had an [deleted].

We really can't point to a specific case where espionage or trade agreement has given them an advantage.

1985 PROJECTION OF SOVIET ABM

Senator GARN. What do you think a Soviet ABM system will look like by 1985? Would they be protecting silos, counterforce systems; what do you think their intentions are?

Mr. DAVIS. My own judgment, [deleted].

Our preoccupation has been to defend against a counterforce attack; that is, an attack against our ICBM forces.

It appears from the design of their systems, such as [deleted] and from the concepts of [deleted].

Senator GARN. We talked about this yesterday or the day before. Is it your understanding at the time we signed the ABM treaty that it was the intention to do two things—to have a follow-on Strategic Arms Limitation Treaty and, second, that by not defending our silos that the Soviets then would not build offensive weapons; is that your understanding?

Mr. DAVIS. Yes, sir.

Senator GARN. So, neither has taken place; we have no treaty and with the SS–17, 18, and 19 it did not deter the Soviets at all, even though we have not deployed an ABM system. I guess they thought there was no incentive to build a silo-killing capability if we didn't defend it.

DESTABILIZING EFFECT OF ABM SYSTEM AND SILO PROTECTION

What is your feeling on the argument that deployment of an ABM system or protecting our silos would be more destabilizing then building offensive weapon systems; do you think the Soviets can build anything offensive that they are not building anyway, without regard to what we do?

Mr. DAVIS. As I tried to indicate on that last vugraph on the formal presentation, our own view, which is perhaps somewhat prejudiced, is that BMD contributes positively to strategic stability; it is not destabilizing, particularly if you are concerned only with defending your own strategic forces, which has been the main thrust of our program.

I think some of the observers in the SALT world who say it is destabilizing to defend cities may have a better case for that argument than for defending the strategic forces.

We think that if you deployed a BMD system with your MX and Minuteman forces, that would be used only to assure a certain survival level if they were preemptively to attack, a counterforce first strike. There is no way to argue even on a theoretical plane that that is a destabilizing doctrine.

As I have shown with the curves, if you look at the exchange ratio or the percent surviving following a first strike, if you have no defense, of course, we are now in a posture so that a very small fraction of their forces can draw us down to a very small fraction surviving, and defense simply shifts that curve so that there is no incentive for a first strike, that regardless of how many they throw at us, we will still have a certain residual surviving, given the right amount of BMD.

So, we argue that not only is that not destabilizing but also contributes positively toward perceptions of survivability and therefore stability to deploy BMD to defend your own strategic forces against ICBM attack.

Senator **Garn**. It seems to me and I suppose there is some merit in hoping the Soviets would not, so it seems to me to turn out to have been more destabilizing by not protecting ourselves.

I would take the absolutely opposite view and suggest that it might encourage an arms control treaty that is realistic rather than being destabilizing. They say if our offensive weapon systems are essentially going to be demolished, we are only going to have [deleted] percent leakage, maybe we might just as well negotiate a treaty to eliminate some of them, if they are not going to be effective. That seems a lot more logical to me than saying defending ourselves will force them to build a new offensive weapon to overcome that.

The cart has been before the horse. They have built an offensive weapon system to overcome our hard target kill capability without the defense. They did what we were afraid of, in any event.

Would you agree with that?

Mr. **Davis**. That is the way it appears to us.

Senator **Garn**. I think the SS-17's, 18's, and 19's speak for themselves, whether it appears that way to you or not. I realize the world is composed of idealists, but sooner or later in world history we ought to wake up.

Mr. **Davis**. I vividly recall when we were trying to get the Safeguard votes through up here in the late 1960's and early 1970's and prior to the treaty, the narrow votes by which we squeaked by on Safeguard, subsequently Jackson's amendment to the ABM Treaty said that if they did not cutback on their buildup of offensive forces, that would be a reason for us to violate or abrogate the ABM Treaty.

Senator **Garn**. I read that testimony in the record 2 days ago, word for word, the dialog with Senator Jackson, Melvin Laird, Senator Fulbright and so on.

Mr. **Davis**. Rather prophetic words.

Senator **Garn**. On all of those questions, though, that would abrogate the treaty, we have not chosen to say that all of those things that they call agreed to would be a violation, not technically, but in the spirit of the treaty, and a reason for us to break out of the whole thing. We simply have not done that.

Thank you, Mr. Chairman.

Senator **Laxalt**. I don't think I have any further questions. I think the subject has been pretty well covered.

Do you have any additional presentation to make, gentlemen?

Mr. Davis. No, sir.

Senator **Laxalt**. We certainly appreciate your help. We may be calling on you again. Thank you.

NONDEPARTMENTAL WITNESSES

PROMPT COUNTERFORCE, DISRUPTIVE ABM AND ROAD MOBILE RESERVE

STATEMENT OF MR. LEE CARPENTER, PROMPT COUNTERFORCE, DISRUPTIVE ABM AND ROAD MOBILE RESERVE

Senator LAXALT. Mr. Carpenter we will proceed with your testimony now.

We are running a little tight on time. If you hit the high points as best you can during the course of your presentation, it will be greatly appreciated by the members of the committee.

Mr. CARPENTER. Yes, sir. When do you have to be out?

Senator LAXALT. We would like to get out of here by 4 o'clock.

Mr. CARPENTER. I can do that very easily.

In the interest of saving time, rather than asking too many questions at the end, if you gentlemen have any questions as we go along, you may ask those questions.

INDEPENDENT STRATEGIC FORCES STUDY

Since I am unknown in this business outside of DOD and represent no one but myself, I wish to make clear I am an employee of IBM, but I do not represent them on this occasion. I developed this study under invitational orders from the Air Force during 1979–80 and I briefed and/or furnished the document throughout the Air Force, DOD, the Joint Chiefs, ACDA, State Department and various congressional staffs, including many of the gentlemen here.

This was done during August 1980–March 1981. The study has been variously reviewed by senior military and Government agencies. I have covered about 27 offices in DOD. The threat aspects have been evaluated in detail by the intelligence community and revalidated a year later. As of mid-April, what I am presenting to you is still true.

Unfortunately, the study is too conservative. The conditions are and will be worse than presented in this briefing. The threat is a synthesis of 20 intelligence documents, all publications of the DIA and FTD. I believe this is a thoroughly tested analysis and independently derived.

You see, under invitational orders, you don't get paid. The only advantage of working for nothing is that no one can tell you how the study is going to come out. That is what I wish to cover.

Now, the things that this study proves, insofar as they are provable, will be briefed to you in less than an hour. This is a year's work, "Evaluation and Capabilities of U.S. and U.S.S.R. Strategic Military Forces, 1975–2000(u)".

EVALUATION OF U.S. AND U.S.S.R. CAPABILITIES

Mr. **Carpenter**. The Soviet strategic military superiority is well established. The Soviet threat to our entire continental U.S. counterforce and countervalue target structure is imminent and overwhelming. Presidential Directive 59 is meaningless for the next several years.

MX/MPS DEPLOYMENT SCHEME

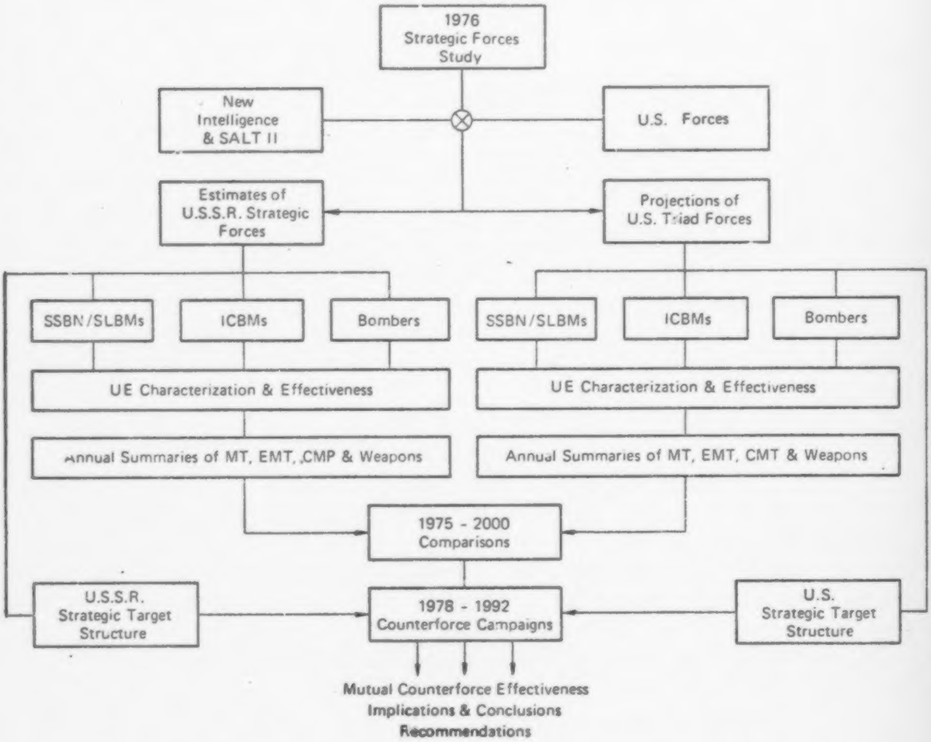
The MX/MPS deployment scheme is fundamentally fallacious and preservation of position location uncertainty is immaterial. The MX missile is absolutely essential as a CONUS-based counterforce weapon system, possibly collocated with Minuteman and defended by Safeguard.

Enduring survivability of CONUS ICBM's can only be achieved by a small mobile force. Further, SALT II is uniformly disadvantageous to the United States and intrinsicially inconsequential to either adversary.

The foregoing is a lot to prove in an hour. If there is something you wish me to emphasize, or if you wish me to speed up, let me know.

STRATEGIC FORCE STUDY METHODOLOGY

Figure 1-1


1976 Strategic Forces Study
New Intelligence & SALT II
U.S. Forces
Estimates of U.S.S.R. Strategic Forces
Projections of U.S. Triad Forces
SSBN/SLBMs
ICBMs
Bombers
SSBN/SLBMs
ICBMs
Bombers
UE Characterization & Effectiveness
UE Characterization & Effectiveness
Annual Summaries of MT, EMT, CMP & Weapons
Annual Summaries of MT, EMT, CMT & Weapons
1975 - 2000 Comparisons
U.S.S.R. Strategic Target Structure
1978 - 1992 Counterforce Campaigns
U.S. Strategic Target Structure
Mutual Counterforce Effectiveness
Implications & Conclusions
Recommendations

STRATEGIC FORCE STUDY METHODOLOGY

The breadth of this study is considerable, as shown in the unclassified illustration (28 subsequent classified charts are deleted). I have used the most ambitious Air Force plans, new intelligence information, SALT II limitations, and then synthesized the intelligence data to produce estimates of the U.S.S.R. forces and project our own triad forces. Then, I used my similar 1976 study as a point of departure. The earlier analysis was used by the Air Staff, in a more favorable DOD environment, as a motivation to accelerate the MX and justify B-1 production.

Based in part on my 1976 study, DOD changed from deploying MX in 1985 to 1983 under the Ford administration. The Carter administration later moved the IOC back to 1986. The arguments were also used for the justification of the B-1 production. That was a fairly useful document. I trust this one will be, although the conclusions are more negative.

I have synthesized and characterized the Soviet Triad and U.S. Triad; in total weapons and the traditional megatonnage, EMT and CMP for an overall comparison. This is the clerical aspect of force structure analysis. These traditional measures are badly overdone and over-emphasized, leading to such sophistry as essential equivalence.

I never write on this topic in the open literature because there is no way to accurately discuss the Soviet target structure. When you also have the U.S. counterforce target structure, you can conduct the counterforce campaign between the two adversaries within the operational constraints of their systems. This has been done and I will present the results.

For the purpose of this presentation, I am only going to consider the ICBM's because these are of most interest to you. This chart describes the U.S. ICBM forces extant today and as projected under the most ambitious plans formulated in 1980. This is the silo hardening program (chart). These are the three Minuteman II wings. These are the Minuteman III wings at Warren, Grand Forks, and Minot. The line shows the completed hardening program and the Minuteman/Mk 12A program, where we are increasing the accuracy to [deleted] and doubling the size of the warhead.

This is a phasedown of Wing V at Warren to accommodate the MX missile under SALT II constraints.

Throughout this study I used 275 MX's in 6,325 MPS sites and show this configuration to be entirely inadequate against a conservatively projected Soviet threat.

UPGRADING MINUTEMAN TO ENHANCE COUNTERFORCE CAPABILITY

There are certain options we could pursue in upgrading Minuteman to enhance our counterforce structure if we choose to do so.

One of the interesting points of the the study is the possibility of placing 100 of the existing Minuteman III force in semis, deploying the trailers around the country and keeping them mobile. We would then have four times as many surviving warheads to fight the war, 3 days after hostilities began, than we would from building the entire MX complex for 275 missiles.

This study shows that the MX survivability is about [deleted] percent. In other words, there will be [deleted] ICBM's surviving if you deployed 275. The reason for it is this chart that drives the entire study. This represents in considerable detail, how the Soviet ICBM forces have been deployed. The chart shows; in the years 1979, 1980 and 1981; a very intensive effort to deploy counterforce MIRV's.

They are fielding, as of right now, about [deleted].

They have a great many [deleted] MIRVs in fifth generation equivalent ICBM's. [Deleted.]

There has been an acceleration of the [deleted] so the Soviets have never been in any more intense deployment activity since they put out [deleted]. This is a unique circumstance that they are exploiting. [Deleted.]

This analysis uses about 820 Soviet ICBM's. I do not utilize some of the follow-ons because I think the estimates are somewhat fallacious. I do not use any of the mobile ICBM's. There are only 820 ICBM's shown and used. I do not show any fractionation until 1988, and I do not use any until 1989.

This study shows that the Soviet Union can [deleted]. That chart has been revalidated and is being used as the official Air Force threat for their year 2000 space study and other planning for their force structures for the rest of the century. At least this portion of my work was useful to them.

COUNTERFORCE MIRV'S

Here are the counterforce MIRV's. They will build [deleted] on the SS-18 and about [deleted] on the SS-19, and then eventually the SS-17 will become [deleted]. It takes no special effort.

If they decide to fractionate; without using any more than the boosters shown in the earlier diagram: you can see their potential is limited only by their money and their [deleted].

Somewhere along here the limit occurs. Their technical capability, which is the sort of thing I have emphasized, provides upward of [deleted] MIRV's.

My purpose in showing this chart is to emphasize that outbuilding them by putting out MPS at a cost of $2 million each is indeed a futile exercise.

EFFECTIVENESS OF ICBM'S AND BOMBERS

This chart describes the effectiveness of our ICBM's and bombers, showing the probability of kill for our ICBM's against their older missile silos and those for their new generation missiles. They knew the capabilities of Minuteman III/Mk 12. Our ICBM was excellent against the old third generation missiles. However, they hardened beyond our capabilities. Everything they have deployed since 1973 has been much hard [deleted] so the probability of kill of Minuteman III/Mk 12 has gone down. The Mk 12A is coming in now and is essentially doubling the probability of kill.

When MX comes in, the MIRV will perform to this line. Consequently MX will be our most important counterforce weapon.

PROBLEMS WITH MX FIXED SITE BASING

This is the analogous chart for the Soviet Union. It describes, unfortunately, the basic problem of MX fixed site basing. This is the hardness of the Titan II installations at [deleted]. This is [deleted] for the MX shelter, [deleted] for the Minuteman/LCC's, and here are the 850 Minuteman II's and III's that are hardened to [deleted].

The early generation SS-17's, 18's, and 19's, were partially effective against our silos. The weapons they are deploying now, the SS-18 Mod 4 and SS-19 Mod 3, have a probability of kill like this, which is very high. Of course, in later years, their MIRV's are even more effective.

These two indicators show that any of the Soviet sixth generation ICBM's produced in the MX timeframe will have that very high probability of kill [deleted] against the MX MPS's. These curves are very flat. Hardening is not a solution. If you went to Minuteman silo hardness, you would make very little improvement. You can't outbuild them and you can't outharden them.

TRADITIONAL APPROACH TO FORCE STRUCTURE ANALYSIS

This chart shows the clerical or arithmetic approach to force structure analysis. Summaries of this kind are provided annually, on an unclassified basis, by the Library of Congress and Office of the Joint Chiefs. You can look at it and say, "Well, things are pretty close. We aren't too bad." The second look at what you can do with these forces provides a far more negative perception of our force balance.

SOVIET MEGATONNAGE

The megatonnage the Soviets have on line is usually three times as high as ours. Their equivalent megatonnage, or ability to burn our cities and major bases, is probably two or three times our capability.

Weapons—they crossed over our line at the beginning of 1980. As of then, they have more weapons on line than we do in all three of the elements of our Triad. Further, their countermilitary potential (CMP) became higher than ours because of their emphasis on destroying hard targets since 1977. They stay ahead after that. Our CMP begins to go up in here, because of the ALCM deployment on the B-52G's.

Their CMP is increasing rapidly right now because of the SS-18 and 19 deployments, and will continue on apace if indeed they fractionate.

SUMMARY AND COMPARISON OF PROMPT COUNTERMILITARY POTENTIAL

This chart is something that the intelligence community thought I might use as a cover for my document, because it contains the things I would like you to remember out of this presentation.

There is a summary and comparison of prompt countermilitary potential. That is, the capability to destroy hardened targets anywhere on Earth within an hour.

The Soviet Union matches our potential here because the only system we have with prompt CMP is the Minuteman III/Mk 12. That is the only useful system.

When we go into the Mk 12A reentry vehicle we essentially double our prompt countermilitary potential. If that is all we did, we would go out through here, as shown.

The Soviets at the end of 1980 had [deleted] times our prompt countermilitary potential. Under present plans of building MX, it is clear we will [deleted] years.

Further, they are [deleted] as hard as we are.

That adds still another [deleted]. That is also the reason why it is very important that we build MX; because if we don't get MX, there is no hope in the situation.

We can't even stay [deleted] years behind them or [deleted] years behind them. We absolutely have to have the MX system in some useful basing configuration.

Now, if you make improvements on Minuteman II, you give them [deleted] accuracy. To us, this is a very major modification. This modest improvement is all you would accomplish—to give you an idea of the scale and importance of their lead.

U.S. POSTURE AT END OF 1980

This chart is relevant to Presidential Directive 59 that came out last summer, with appropriate fanfare in the Washington Post. This was our posture at the end of 1980; the EMT we had [deleted] from all sources—bombers, ICBM's and SLBM's.

Under existing policies; the present bomber alert rate of 30 percent, having half of our SSBN/SLBM's at sea, and riding out an attack of ICBM's, all we would have left is [deleted] after the first hour of the war.

If we wanted to go in and deliver the surviving weapons, this would be further reduced, resulting in a really nominal and marginal ability to respond in a countervalue attack.

COUNTERFORCE WARFARE

If we change our strategy and decide that we are going to fight a counterforce war, as inferred by Presidential Directive 59, here is our posture. You convert all of this to CMP, precluding attacks on cities. Then, these same weapons equate to 3,031 countermilitary potential. Using the same degradation and operational attrition factors, you come out with 5 percent of the capability one needs to engage the Soviet Union in a counterforce war. That is how miserable our situation vis-a-vis the Soviet Union has become in the last 10 years.

Ideally, our at-sea SLBM's would be able to cover all of their war sustaining targets. Since we obviously would lose the short war, we would use these weapons on their soft targets. However, if we must attack their 3,300 countervalue targets, we would be able to cover only 40 percent of them. If we deploy Trident, perhaps 58 percent.

I believe that any administration would be irresponsible to get us into a general war from a normal alert posture because it is almost inevitable that we would lose.

Here is the next thing that I wish to demonstrate from these counterforce calculations. In 60 days, an analyst with a punch calculator can deduce these things from the data base I have described. I can determine the yearend date when there will be [deleted] percent destruction of the U.S. counterforce targets, and that is [deleted]. If the Soviets attacked Minuteman and Titan II today, they would destroy all but [deleted] of the silos. They would have that accomplished in the first hour of the war.

To achieve a comparable U.S. capability, assuming we build MX as described (275) and launch out of the bases before they are destroyed, will require a diligent effort until 1991.

They are [deleted] years ahead of us in prompt CMP.

I evaluated the Air Force long-range plans as part of this study and bit the hand that fed me. This study shows the Air Force plans to be utterly inadequate for the task.

I also evaluated the U.S. and U.S.S.R. countervalue potential following a mutual counterforce exchange. The remaining Soviet forces provide at least twice the weapons needed to destroy our countervalue targets. We have less than half of the forces needed to destroy their countervalue target structure.

PRELAUNCH SURVIVABILITY OF MX/MPS

Following the 1978–85 counterforce analysis, I went into the prelaunch survivability of MX/MPS during 1986 and found that; in maturation, 1987, 1988, and 1989; to be [deleted] percent. When I gave this briefing at SAC Headquarters for 7 hours, they found this survivability surprisingly low, but they said, "Well, perhaps."

I also cautioned them, "When you come to Washington you will be faced with the argument, Why don't you put MX in quonset huts and save $12 billion for concrete, while only degrading MX/MPS survivability by 3 percent."

I hope they have an answer. I appreciate that some of the people in the audience are required to answer that question—if there is an answer.

The next thing that I have identified—and I will leave this out—are intelligence indicators that I think we ought to monitor. These factors will show if the Soviets intend to pursue aggressive initiatives during the next 10 years. I have identified seven such longer term indicators.

I also provided them with some recommendations of what we might sensibly do to improve our strategic posture during the 1980's.

I will try to support all of these suggested actions.

U.S. TRIAD CAPABILITIES

If we consider the problem we have in attacking the Soviet Union; ignoring their SS–20's, any subsequent mobile ICBM's, and IRBM sites we would prefer to destroy as threats to NATO; then they currently have 1,300 operational silos. This chart also shows their soft counterforce, their launch control facilities, [deleted] submarine bases, [deleted] C^2, and [deleted] communications centers. They have [deleted] strategic weapon storage and fabrication facilities; essentially [deleted] times as many as the U.S.

From a normal alert posture and launching under attack, as either intelligent adversary must, this chart shows all we can do. This summary target line, if we attack with our ICBM's and SLBM's, will be reduced to this level. If they wait for another 5 to 10 hours for our bomber force to come in, we can further reduce their targets to here.

The mobiles cannot be addressed [deleted] and there is this tremendous number of surviving sites. So even a day into the war they will have at least [deleted] intact silos in spite of the best we can do from a normal alert posture. These are the remaining C^2, C^3, and test silos. That shows all we can do.

COMPARABLE U.S. TARGET STRUCTURE

If you consider the comparable U.S. target structure, this chart shows their problem, including our 1,052 ICBM silos. We have [deleted] nuclear storage facilities for [deleted] targets. If we deploy MX in 5,325 DSMPS, we build a structure like this, rather than 4,600 MPS.

The interesting thing about this, they do not use their airplanes at all and they do not use their submarines, except for soft prompt counterforce targets.

This is how we compare to them. There would be, as of the end of last year, about [deleted] Minuteman left, about [deleted] LCC's and some air bases that are neutralized but not entirely destroyed, and a few remaining nuclear storage sites. Giving them time to retarget, in less than half a day, all of the remaining sites would be eliminated. This condition would obtain for the foreseeable future.

Building MPS, there would only be [deleted] MX's remaining in those shelters in any given time. We will have essentially spent $55 billion in 15 years and ruined two States while accomplishing nothing. Since we are starting from behind now, we can't afford any mistakes like that, or of that magnitude.

U.S. POSTATTACK OPTIONS

This chart shows what we can do after we have fought or endured the counterforce war. This is what is left of our ICBM force. These are our at-sea SLBM's. They have 300 population centers [deleted] theater war support and [deleted] war sustaining facilities. They have an immense industrial base, several times ours, at least in terms of target locations.

This chart shows their problems. Some people say, "I would rather have my forces and their problems." That is nonsense. We face this situation: They only have [deleted] targets to destroy; [deleted] theater war support, [deleted] war sustaining, and 230 metropolitan areas; and these are forces they have for the countervalue attack.

Ironically, they can now afford our policies and we no longer have sufficient, secure forces for the task. They can ride out our attack and still wipe us out.

UNITED STATES ICBM /SOVIET ICBM COMPARISON

This chart compares ICBM to ICBM, getting more immediately to the concerns of the panel. I have extracted the surviving silos from the balanced counterforce attack. These are the Minuteman silos now surviving and the progressive effects of fifth generation equivalent Soviet ICBM deployment.

We have reached stability here as long as they have an [deleted] CEP. When they begin to get the [deleted] CEP, the Minuteman silos disappear. If we go to work on them, as I pointed out, they have [deleted] surviving an ICBM attack. If they wait 15 hours and endure our alert bomber force attack, they still have about [deleted] ICBM's.

SOVIET COUNTERFORCE CAPABILITIES

This decline in remaining forces occurs in considerable measure because they are expected to phase down; we hope. One of the signs of possible aggression initiatives during the next 4 or 5 years would be a slower phasedown than is now projected. Further, if they add some purely mobile ICBM's, we have no way of knowing our probable degree of success in targeting the mobile launchers.

Again, surviving MX missiles just do not show on the chart which represents the surviving force. This is [deleted]. You go out here, 6,325 MPS and 275 missiles. Given that projection, which is conservative; without fractionation or use of fractionation until here, nor fractionation of more than one-third of the SS–18's; at no time will there be more than [deleted] MX's surviving in 1988, 1989 and thereafter. That is accomplished with only one-on-one and backup targeting which they have been planning to do for 20 years. That is the very basic problem of the MX/MPS basing scheme.

The question then becomes, what do we do about it? I will use No. 3 of seven conclusion charts where we consider policy. First of all, I think I have shown we cannot afford a second strike. Next, we cannot conduct a counterforce war unless we effectively employ most of the Minuteman III force.

War termination is not realizable without counterforce attack. They will now tell us when the war is over if we do not attack their counterforce, thereby eliminating the ability to continue prosecution of the war. We will not be able to terminate the conflict on terms least unfavorable to the United States.

ICBM LAUNCH ON CONFIRMED TACTICAL WARNING

There is a necessity to launch ICBM's on confirmed tactical warning. We must preclude prelaunch destruction of Minuteman because there are simply too many targets to be destroyed by our forces unless we do launch under attack. Accordingly, we need an appropriate declared or defacto policy.

The U.S. is the great state responsible to keep half of the world free against the other half which is now militarily stronger than ourselves. With only 6 percent of the world's population, a simple deterrent such as Great Britain and France enjoy is not a viable stature for the United States. We must begin the MX deployment to redress the currently unfavorable strategic force balance.

The Soviet policy has always been stronger than mere deterrence. Even when they could not prevail, they have always planned and prepared for prosecution of a general war. Until recently, they did not have the necessary forces. Now they have both a stronger policy and stronger forces.

SALT I and II are uniformly disadvantageous to the United States and the limitations are inconsequential. Either adversary can readily arm to destroy the rest of the world within these so-called limitations. If the Soviets look back from the year 2000 at our time, they may well consider SALT I and II as one of their great victories in the 20th century.

CONCLUSIONS AND RECOMMENDATIONS

We are now reduced to a conditional ICBM deterrent, that is, if you cannot launch from the silos prior to arrival of the Soviet attack. Consequently, we have two basic needs. The first is a prompt, potentially massive counterforce capability to be launched under confirmed tactical warning.

We must be able to respond when we detect a large Soviet SLBM/ICBM attack on the CONUS. We need to emphasize surveillance systems, redundant C^3 and a survivable NCA.

The second major requirement is pure mobility for 15 to 20 percent of our ICBM force to insure prelaunch survivability. MX/MPS basing is attempting to solve the enduring survivability problem and provide the prompt counterforce as well. The proposed system is not very well designed to perform either function.

We must separate out the enduring survivability requirement for fulfillment by means of pure mobility. If we want any useful ICBM forces extant in the United States 24 hours after the war starts, these weapons must be mobile. If you are going to mobile basing, the ICBM must be small.

Overall, we require near-term prompt counterforce enhancement. We need to extend the MK 12A guidance and reentry technology to Minuteman II and retain the Minuteman III MK 12A's. When MX is deployed, these Minuteman forces should be retained to the degree warranted by United States-Soviet relationships or as limited by a SALT III agreement.

CONSIDERATION OF BASING METHODS

This chart was prepared under the Carter administration. My briefing at SAC headquarters in October 1980 particularly emphasized that they should initially deploy MX in any basing configuration, even if they had to take $50 million worth of useless concrete at each site to obtain each missile. Then, in times of stress, they could erect the missile in the open, allowing the Soviets to appreciate our readiness to launch under attack.

Given the necessity to promptly develop and deploy MX in any configuration, we must also reconsider the basing method while avoiding the concept distortions imposed by SALT II. The MX basing mode and operational concept must be responsive to the DIA/FTD threat. The people responsible for MX basing have not been reading their own books. I did not originate any new threats. I simply synthesized and analyzed their official threat very carefully and conservatively. This established that MX/MPS basing was fundamentally fallacious and that PLU is immaterial.

The MX also needs a somewhat larger warhead. The MX ought to have a [deleted] warhead instead of a [deleted].

ABM DEFENSE OF SELECTED MINUTEMAN FIELDS

The next task is to study a partially effective ABM defense of selected Minuteman fields. That was an abstraction when I presented it in August 1980. This is now under serious consideration by some of the military people in this room.

ENDURING ICBM PRELAUNCH FORCE SECURITY

The next issue is ICBM prelaunch force security. This can best be achieved in the CONUS through purely road-mobile ICBM's for counterforce and countervalue reserves. The system should not be used for prompt counterforce time-urgent targets. The C ^{3} problem will be so difficult with the purely mobile ICBM system that we must avoid any requirement for launching during the first hours of the war.

ICBM DEPLOYMENT WITH DISRUPTIVE ABM DEFENSE

The foregoing has summarized my year's work on the U.S./U.S.S.R. force posture. I gave this briefing to the DOD transition team people at various times and places. Toward the end of this activity Mr. W. H. Taft, IV, asked if I knew what to do about the MX basing problem. I did not have any solutions, but said I will study the matter.

FTD originated an excellent idea. I would like to show you nine concept charts on what I think is a viable solution. Colonel Montulli has started a study of this concept recently under the auspices of the air staff and has asked me to consult on the problem. I think if they will pursue this, the Air Force will give you a promising MX basing alternative and save us a lot of time and money.

This is the way the Soviets will destroy the Minuteman force today: They are [deleted]. The silos are far enough apart, generally about 4 miles, [deleted].

[Deleted.]

The Minuteman field, with 150 silos, including 15 launch control centers, requires that there would be [deleted] warheads coming in during a period of [deleted] seconds. Since the RV's are going at these tremendous speeds, they are actually fairly widely spaced.

The gentleman from Huntsville mentioned this, but he did not point out that each of those [deleted] cubic miles of space, uniquely, if you consider a random distribution of MIRV arrivals. MIRV timing is a nontrivial problem. [Deleted.]

The next thing, [deleted] as long as they have an [deleted] foot CEP, they have to do that. As soon as they get [deleted] foot CEP they can [deleted].

This chart makes that point. They will have the [deleted] so there will be only [deleted].

[Deleted.]

CURRENTLY PROPOSED MX SITUATION

This is the currently proposed MX situation. The MX shelters are 5,000 feet apart. They moved from a spacing of 7,000 feet, presumably to save real estate, but this has another very desirable feature, in that the attack must come in at scaled height of burst on each one. [Deleted.]

Here is the next feature: To begin with, build a silo that is stronger—say 5,000 psi, spaced 3,000 feet apart to make the fratricide problem more difficult—if they go [deleted] percent survivability.

The thing to keep in mind is this: If we consider ABM defense or hardening of fixed sites, all we will achieve are some tens of minutes of force security. That is all we will ever reliably achieve with any kind of terrestial ABM defense.

In spite of anything the people from Huntsville can do, the Soviets will be able to ladder down on almost any ABM defense configuration. Their numerous forces generally preclude sustained, effective ABM defense.

PARTIAL DEFENSIVE CAPABILITY

Here is what I am suggesting: Since we cannot fully defend our silos, then we should opt for a partially effective defense. This chart is in nautical miles. Above 50 nautical miles is exoatmospheric. RV's will come in during [deleted] seconds in a trajectory like this against the Minuteman wing at an angle of [deleted] degrees. You can launch the Spartan ABM up into this threat tube on a periodic basis. X-ray impulse will induce spalling on the MIRV's degrading their accuracy.

These are the [deleted] numbers, assuming a two-on-one attack on each Minuteman silo, giving a survivability of about [deleted] percent. If you got an additional dispersion of [deleted] meters, you could substantially increase survivability of Minuteman. The same is true in later years as well, assuming these numbers hold up under Colonel Montulli's detailed analysis.

This is the same effect against 4,600 MPS shelters hardened to 5,000 psi. I am using this from FTD data. I do not espouse 4,600 hardened shelters. The detailed justification is yet to be established for empty shelters of any kind at any time.

CEP IMPROVEMENT

As time goes on, the CEP's improve. If the ABM can disrupt the CEP, if you stay [deleted] meters, the survivability might be on the order of [deleted] percent. This leads to a broader, better concept.

You then could locate the MX in this kind of spacing, hardened to 5,000 psi, within the existing Minuteman fields. If you build MX silos spaced at 3,000 feet; or somewhere near this distance, a separation to be very carefully determined; you will initially afford an existing Minuteman silos some small measure of protection in the attack by simple proximity. This increases the difficulty of two-on-one targeting against a particular Minuteman site. [Deleted.] This, in turn, will concentrate the threat tube somewhat and simplify the defense problems.

One man like myself can, with a year's work, identify these problems, but you cannot solve such broad and difficult problems other than conceptually. All I have been doing for the last 6 months is encouraging the responsible military professionals to examine and elaborate on this concept.

Senator LAXALT. Will this last chart presuppose we will absorb the first strike?

Mr. CARPENTER. I don't believe that would be a good idea at any time.

Senator LAXALT. I agree.

Mr. CARPENTER. This deployment concept does give you some insurance. If the National Command Authority fails us, as in the last 4 years at least—I forget I am on the record here—the concept is [deleted].

When you consider $10 billion for ABM defense, the thing you want to understand is that you are using that $10 billion to buy yourself still another hour or less of procrastination. It is cheaper to make up your mind. It comes down to that.

SAFEGUARD AND MINUTEMAN SELF-DEFENSE

This last chart summarizes the foregoing; since you gentlemen have not seen this chart, I offer it to you as well.

Consider phase I of reestablishing Safeguard and Minuteman ABM-defense for at least three Minuteman wings that are under the PARS coverage at Minot, Grand Forks, and possibly Malmstrom. You would augment this by a [deleted] because you do not require precise information. You know the general location of the threat tubes and the intended burst altitude. The only new thing you have to know is when the boosters leave the Soviet Union. If they destroy the PARS in Grand Forks, which they will in 20 minutes, you can still do the programed barrage of Spartan ABM's in those threat tubes while blind, if you have to.

We must also establish an employment doctrine for launch windows against Soviet objective targets. If the National Command Authority is functioning, Minuteman can be launched under attack using PARS to determine the proper launch windows.

Phase II would bring about the earliest collocation possible in some of 350 deep Minuteman silos. I understand the MX, which is 71 feet in length, will fit in some of those silos. If you can deploy them in defendable Minuteman wings, that will be progress.

The final phase will be collocation of very hard MX silos within the Minuteman wings. Solution to this overall problem requires about 100 really expert people. They must take into account pin-down attack, spike attacks and MARV's. [Deleted.]

I have no idea on the associated costs.

We must also consider a mobile Minuteman or other small ICBM supplement for the survivable CONUS force. Our submarine-based missiles are the premier survivable force. If we decide to augment these SLBM's with a truly mobile CONUS force, this will essentially produce a "quardad." The times and threat may warrant this extension of our deterrence.

That is the end of the presentation. Thank you.

Senator LAXALT. Do the gentlemen from the Air Force have observations or questions?

DEPARTMENT OF THE AIR FORCE

STATEMENT OF LT. COL. LOUIS T. MONTULLI, USAF, ADVANCED ICBM SYSTEM STAFF SCIENTIST, SPECIAL ASSISTANT FOR MX, DEPUTY CHIEF OF STAFF, RESEARCH, DEVELOPMENT AND ACQUISITION

Colonel MONTULLI. I would like to make a comment on several parts of what Mr. Carpenter said. I do not want to challenge the image that we are not exactly ahead. This particular analysis certainly looks at the worst case. It looks at all the potential things the Soviets can do.

Nevertheless, we are behind. What to do about it is really the question. The suggesion that Mr. Carpenter made at the end bears comment.

Our FTD people and several analysis laboratories and, I believe, sincerely, with the help of Mr. Carpenter over the last 6 months and a year and a half in general have looked at some phenomenon, where now we look at the situation more as a warmaking scenario, quite different than we did in the 1960's and 1970's, where we thought we could put out a system and have it invulnerable for several decades. In that kind of situation, you look at missile defense and look at things that can be done in conjunction with the Soviets in different ways.

You look at it in trying to complicate the Soviet attacker when he is serious with thousands and thousands of RV's. Besides LoAD's, besides overlay defense, one has the newer ideas in the last 6 or 8 months, which is to look carefully at nonphenomena and timing of such a war.

MULTIPLE SHELTER THEORY

Carpenter brought up a tradition which we find to be true in MX/MPS or Minuteman, if you clump a lot more shelters together. The secret to the technique is having several thousand, 4,000 or 5,000, shelters that are hard enough to sustain bursts between them that are now on the order of 3,000 to 5,000 feet apart.

If that is the case, the attacker's condition when he is attacking that large field is driven by the need to bring his RV's down in such time that he is not killing himself by one phenomenon or another with the nuclear burst.

When he faces this problem, he generally has to face it in the ideal sense of trying to bring his RV's down almost simultaneously or very close in time, one to the other. When that happens, as Mr. Carpenter said, he is putting a lot of RV's in space in fairly close proximity to each other.

Imagine [deleted] RV's spread out 200 or 300 kilometers. We found through some calculations if that be the case, a very small number of reentry vehicles that we could send up in a defensive mode numbering like [deleted] could [deleted] the sky in such a way that effectively destroys what was his very advantage he was using, which was very high accuracy.

[Deleted] as we talked about in the late 1990's, could be changed into things like 1,500 CEP which is basically not very effective against hard targets by exoatmospheric bursts. These are the calculations we are looking at very carefully.

We have found out so far that if we take the Minuteman force of 1,000 Minuteman spaced 3, 4, 5 miles apart—and he showed one number that in fact is one of our results of trying to change a prediction of today's survivability of approximately 20 percent survivable—and move it up to 40, that works out effectively in today's environment of about [deleted] CEP.

As we move to a Soviet prediction of [deleted] CEP, it is not [deleted].

If we force him into facing 5,000, 6,000, 7,000 targets, he is faced with *x* number of missiles and *x* number of empties, or you simply have them all filled with missiles, as he believes they are, if he now attacks those and they are spaced 3,000 and 5,000 feet, he faces the other problem that was talked about—very little defense burst, it appears, would shake up his attack.

There are other things he can do and the problem is many, many variables long, and so we have initiated a very rapid 6-month study, but it initially, truly looks promising.

We keep coming back constantly to now wanting to have multiple activities to let him be faced with.

It all starts, however, with fairly close spaced things that start with the number 4,000 to 6,000 in number. Then we start talking about atmospheric defenses, exoatmospheric defense and LoAD.

These combinations clearly look to us like ways he could not overcome when he is trying to face us with [deleted].

Our answer is a bloody nasty wargame we are playing, compliments of Mr. Carpenter, to that end.

Senator LAXALT. Thank you very kindly.

RESEARCH, DEVELOPMENT AND ACQUISITION

STATEMENT OF MAJ. VICTOR D. BRAS, ADVANCED ICBM SYSTEM STAFF OFFICER, SPECIAL ASSISTANT FOR M-X, DEPUTY CHIEF OF STAFF, RESEARCH, DEVELOPMENT AND ACQUISITION

SOVIET MISSILE PREPAREDNESS

Major BRAS. I might remind the chairman and the committee of General Burke's comments that the Soviet Union in our opinion is prepared, should we ever get the treaty. If the Soviet Union were to do that in the ballistic missile defense area, then we would be talking in terms of our offensive requirement being more than [deleted] since we would be going against defended targets on a retaliatory strike. That has to be weighed in the cost calculations and I don't believe it has been at this point.

Senator GARN. Once again you are assuming they are only going to do it if we do it. I don't know how many times we have to look at what they have done without our doing anything. I know I sound like a broken record but over and over again I have sat in these committes for 6 years now and before that in that blue suit and we keep saying if we do this they are going to do that. So we don't do it and they do it anyway. I can't buy the argument that if we put a BMD in, they are going to. They are going to anyway. If I am still around here and you are a general coming back to testify, I am going to say I told you so.

Colonel MONTULLI. I heard you for 2 days. I sympathize with your remarks.

Senator GARN. General Burke listened to me for longer than that.

Colonel MONTULLI. I have been with this system for 6 years. The difficulty is that we seem to be overwhelmed by the degree of the problem. Mr. Carpenter has indicated it is indeed the maximum potential of what the Soviet face us with. It scares the hell out of us.

Senator GARN. I am scared if it is only half that bad.

Colonel MONTULLI. At one time for a small number of dollars with no effect economically we could have solved that problem. We are beyond those days. We need several sets of solutions. I wish we could choose one.

Senator GARN. One thing that disturbs me very frankly about the Air Force's position, particularly over the last 2 years, a number of times we have made the criticism that that can't be done. First, is was the race track. Then we found out we could do away with certain parts of that, very grudgingly, I should say, DOD, Brown, and Perry. There have been several changes. Now I am hearing the last 6 months how we are looking at some new calculations. Why is there so much resistance all the time until you are pushed and shoved by various and sundry people and then suddenly some of you say "You people are right, there are some changes we can make." Then it seems you come back and say "Well, there was some justification for that. As a matter of fact, it makes it better."

HIGHWAY MOBILE MISSILE SYSTEM

Colonel MONTULLI. I would like to give an example. At lunch Mr. Carpenter was suggesting he thought I would react negatively to putting our mobile system on roads and trucks as not an excellent idea. I can tell you militarily and for certain dollars it is an excellent idea. It can be made quite survivable to a large extent. When asked why we don't pursue that I suggested also at lunch if I could get a resolution from Congress that would tell us that they would not mind having 25,000 pounds of explosive power strapped to a plutonium warhead, which is the smallest single missile we could build, running around on the roadways, I think I could convince the Chiefs of Staff and the Secretary of Defense in 15 minutes. That sticks in our craw.

We don't know how to get around that fundamental point. There are fundamental constraints. Some may be perceptions on our part, some damn strong.

Senator GARN. You might be surprised at all the opposition to this basing mode because I will guarantee you right now the President has not made the decision, you don't have the votes. You don't have close the votes either of Senators who haven't looked at it or it is not coming to their States. They look at it as a great monstrosity of a Rube Goldberg system ever designed. It will cost $100 billion before it is through. That is what we are going to pay for it unless you get inflation under control. You might be surprised at some of the opposition when you talk about saving dollars.

That really is not nearly as dangerous as driving around on the roads with the chlorine tankers. We kill 50,000 people on the roads every year from just automobiles. I would not expect to kill a single soul. You have to sell that idea and start convincing some people that there is some danger.

I used to carry atomic weapons all the time in an airplane. One time we tried to drop one when we had an engine fire out over water. Five of us went back and went through our memorized procedures. We could not even get it out of the airplane. Finally I went down with the airplane. After we had been in the water for 18 hours they picked us up. They asked us where is the bomb? "We don't know. It is in 6,000 feet of water someplace." We could not jetison the damn thing.

Senator Laxalt. Where did the Air Force or anybody else get the perception that there would be this deep resistance to going road mobile? John Glenn has pitched this real hard and it makes a lot of sense. He tells me the public unacceptability is so strong out there he did not think it would fly.

PROBLEMS WITH ROAD MOBILE SYSTEM

Colonel Montulli. If it does not come from discussions with people who are supposedly able to make those assessments, it certainly comes in my own case from experience in the last 4 years at DIA on MX and facing the problem of road mobile with an explosive force of 25,000 pounds equivalent with a plutonium warhead. Plutonium is a very nasty thing to have scattered over the countryside. Three Mile Island, what has happened to us since then, a few bombs dropped over Spain. We have not flown with a live bomb over America.

Senator Laxalt. Are any of our allies moving these around on a road mobile basis?

Colonel Montulli. Only in the sense they are now talking about a road mobile system in Europe for Pershing. But that road mobile system will be contained. It will be within a military base garrison.

Senator Laxalt. It won't be on traveled highways?

Colonel Montulli. It will not be under normal peacetime. If we were to do the same, we would have a system that would be worse than depending on warning of any type of system we talk about. It would take [deleted] hours to generate any type of survivability.

OPERATIONAL ENVIRONMENT IN EUROPE

Mr. Carpenter. The operational environment in Europe would be much different. There would be excellent reasons for holding Pershing to a base for prelaunch security purposes. The number of people available for potential sabotage in Europe is immensely larger in a far smaller area than the United States.

In the United States we have the best and largest road system in the world. We can hide small mobile ICBM's among 11.5 million trucks and make the trailers look like those trucks. Essentially, we have 11.5 million mobile decoys already built, without cost to the Government.

Senator **Garn**. Would you agree that is the public perception as you define it right now but, it is not a dangerous thing to haul those around on the road.

Colonel **Montulli**. I would not agree with that. The public perception is that it is a dangerous thing.

Senator **Garn**. That is what I said. Would you agree that it is not dangerous? The perception is there.

Colonel **Montulli**. More dangerous than moving either of those components separately. The combination is what makes it very dangerous. I believe we can make it very safe. I can make it as safe as the potential of an explosion or serious accident at a nuclear generating site. I know that worked well from experience of 10 years ago. I believe, myself, as a scientist I would rather live next door to a nuclear generating plant than ride to work five times. The probability of being killed over the lifetime is less than that of driving to work five times.

I don't think I could convince my next door neighbor who is a nonscientist.

SEA-BASED SYSTEM

Senator **Laxalt**. How do you feel about sea-based?

Colonel **Montulli**. That is an excellent system. In the time of the 1980's that we are talking about it will be the predominate leg we will rely upon for the Soviet not to do something silly, if you will. There is the question, and I cannot get into it at this level of the security, of that system over time. In the late 1980's with what we are talking about in the plans of the Department of Defense, we are talking about [deleted] subs.

Mr. **Carpenter**. May I make an observation about sea-based, sir? If you are thinking of sea-basing MX, that would be very difficult and does not seem to make much sense. MX is primarily a prompt counterforce weapon; you can't use it for prompt counterforce targets if you base the missile at sea.

Going to sea for prelaunch security is an ideal mode if you have the proper missile. The idea of SUM, for example; which intends to strap MX's on the submarine and deploy in the deep ocean to get away from the Van Dorn effect; would be immediately in competition with the established Poseidon and Trident submarines. These SSBN's/SLBM's evolved during the past 25 years as the best realization of a sea-based deterrent. Accordingly, it will be more useful and economical to build additional numbers of these weapon systems.

Taking MX to sea and building special submarines to accommodate this large missile is illogical becaue this generally precludes the principal MX mission. The MX must be in fixed sites having known locations to allow coordination and timing of the attack. Mission timing must be one-half to 1 second from missile firing in the CONUS to impact in the Soviet Union.

If the MX SUM's are dispersed over the ocean or if the missile is dropped overboard from surface vessels, floated and fired; a prompt coordinated attack with the exquisite timing necessary to destroy a Soviet missile field—there are [deleted] fields, similar to ours—would be most improbable.

Senator **Laxalt**. How about deterrence?

Mr. **Carpenter**. As a pure deterrent; certainly.

Senator **Laxalt**. As a counterforce for the reasons you mention it just is not there.

Mr. **Carpenter**. There could be mitigating circumstances. If the missile was assigned to non-time-urgent such as [deleted] hardened weapons storage sites in the Soviet Union, these would be part of their hardened counterforce targets. However, C^3 and timing problems would variously prohibit use against their silos, airbases and submarine bases.

IMPORTANCE OF DETERRENCE

Mr. **Ballenger**. Isn't deterrence what is important for this coming decade?

Mr. **Carpenter**. If I can answer the question broadly, our prior deterrence has been enjoyed rather inexpensively. In the 1950's we had $10 billion worth of bombers that provided our deterrent. During the 1960's and 1970's we had $20 billion worth of ICBM's which brought us deterrence and superiority much of that time. Now we are inferior. The Soviets have spent a quarter of a trillion dollars more than we have in the last 10 years and obtained quite a lot for their money.

The ultimate deterrence belongs to the adversary who is going to win the war. If you believe this study, we are going to lose the next war and they will prevail to the degree that such a war is winable. Accordingly, we are now more deterred than they.

We are going to have to establish a much higher alert status with the Triad forces over the next 5 years to accommodate our new posture as second among equals. For example, rather than buy a new bomber immediately, it is logically more important to spend one-tenth as much and place more of the bombers we have in a higher degree of alert status while training some additional aircrews.

Senator **Laxalt**. Are you a student of the Soviet people and their leadership?

Mr. **Carpenter**. Modestly. I have been studying the intelligence reports for 23 years.

SOVIET WORLD DOMINATION DESIGNS

Senator **Laxalt**. Do you think, unless it would be the most calamitous circumstances, they would truly think in terms of first strike?

Mr. **Carpenter**. I think Nitze put it better than I could. He made the observation the Soviets do not want war, they want the world. Of course they are patient. If they can take us in 50 years without war, they are willing to do so and they are well underway. If present trends in Europe continue, Europe could be Finlandized in 10 years.

If we are not bluffing, we certainly ought to be because of our posture. They have, over the last 5 years, deployed the most awesome destructive machine ever known to mankind. We will require 10 years to duplicate their force posture. That is something we should not forget. They are a totalitarian state. They don't have to consult. We are in a very difficult and enduring situation.

STRENGTH OF TRIAD LEGS

Senator **Laxalt**. Assuming we were in the difficulty you described here in terms of land-based, don't the other two legs of the Triad support us substantially in the 1980's?

Mr. **Carpenter**. They all make a useful contribution, but have these problems. From a normal bomber alert posture we are going to get 30 percent of the bombers off and later on 40 or 50 percent. The rest of the aircraft are lost in the first 20 minutes of the war. Consider a new bomber. If this aircraft is on 30 percent alert status, we will lose two out of three of all new bombers we deploy. I have been advocating the B-1 for 20 years, but this reality must be recognized. If we go up to 50 percent alert rate, we could lose at least half of the bomber force during the initial attack.

Senator **Laxalt**. Does that in itself have a tremendous deterrence value as far as the Soviets are concerned?

Mr. **Carpenter**. I feel that we have an adequate deterrence. The Soviets deterred us, for all practical purposes, for 30 years while being inferior. If we are reasonably astute, we can deter them from our secondary posture for the 10 years required to rebuild parity. We have to be more careful in our rhetoric, initiatives and weapons system developments and be more alert for possible Soviet aggressions.

UNITED STATES/SOVIET NUCLEAR DISCUSSIONS

Senator **Laxalt**. Don't you think our realistic long-term goal is to sit down around a table on an equal basis and hammer out an agreement?

Mr. **Carpenter**. On a very long-term basis. I have analyzed some interesting Soviet intelligence reports. I was asked to review the so-called Penkovsky papers in 1964. These were top secret planning documents that Lieutenant Colonel Penkovsky allegedly took to the British Embassy in Moscow. I saw the secret translations over at Andrews AFB and studied them for a few weeks. My lasting impression is that the Soviet state is basically malevolent and I have not changed my mind since reading those papers. It was like reading another person's diary. [Deleted.] I think the Soviet governmental system is the great evil force in the world in our time.

Senator **Laxalt**. You don't think we ought to waste time negotiating with them?

Mr. **Carpenter**. I think we must. So far, we can't be accused of being shrewd Yankee traders. The agreements are uniformly disadvantageous to the United States and intrinsically inconsequential.

VALUE OF VERIFIABLE TREATY

Senator **Laxalt**. Suppose we could enter into an agreement with decent limits unlike the dog presented to us in the form of SALT II. Let us suppose it was verifiable. Isn't that worth the effort?

Mr. Carpenter. Absolutely. Churchill said it is better to talk and talk rather than fight and fight. You must keep on talking because what I have described is hopeless.

Senator Laxalt. This whole thing is depressing. It is an open-ended arms race. I think it will blow the world up unless something is done. I don't see anything that can be done other than sitting down and having President Reagan sit down with great credibility and hammering out an agreement.

Mr. Carpenter. That is correct, but it has to be an agreement and truly a limitation. The sophistry and nonsense of the last 12 years will not do it. The Soviets very carefully crafted these agreements to accommodate their force structure planning. In the world view, we will look like the bad guys because we want to start over.

SALT I and II are terrible agreements. I believe President Carter initially had the right attitude. He put them in a state of shock by suggesting we will really cut out several hundred ICBM's. Very sensible, but highly unsalable to those people because they have other adversaries besides the United States.

Senator Laxalt. I have lived with this problem for the last several years. How could we have been so naive in dealing with them?

Mr. Carpenter. Forgive me for paraphrasing too much history. The SALT agreement started in 1968 with the Kissinger initiatives under Nixon. They were an excellent idea because they wanted to halt the arms competition before the Soviets MIRV'ed their ICBM's. The Soviets used these negotiations, including the SALT I agreement in 1972, as a public preoccupation while they proceeded in a major, unilateral armaments effort.

Brezhnev told President Nixon that he was going to build up to the SALT I limits, as he had agreed to them. The Soviets have done that while we have not. Next, we had the disaster of the Nixon administration and the unfortunate and enduring mood that was established. Henry Kissinger went on to the next administration. For reasons best known to him, he continued this travesty under the Ford administration. When Ford finally stopped the process, to his credit, this may have hurt his campaign for reelection.

Ford may have wanted an agreement as badly as Carter, but he perceived that it was fallacious. He also saw the Backfire as truly a threat, so he did not approve the agreement. President Carter renewed the negotiations consistent with his deep personal convictions. His somewhat simplistic theosophical preferences were gradually imposed; either by default or intent; on U.S. foreign policy, economic policy and defense policy. These very disadvantageous agreements that were formulated under Kissinger were consistent with Carter's objectives.

This became a national misfortune, because Carter wanted to further disarmament, but for different reasons. He did not have Kissinger's cleverness. Kissinger at least kept the B-1, MX, and the cruise missile as reserves for negotiations.

Senator Laxalt. Did he have that much influence over policy decisions of this charter?

Mr. Carpenter. I think so.

Senator Laxalt. You really think he had that kind of leverage?

Mr. **Carpenter**. I think he was very prominent. The fact that Ford carried Kissinger as far as he did in the 1980 Republican Convention indicated that Ford had great trust in him. I feel while history may treat Ford and Nixon—and this is my Republicanism, forgive me—a little better than we do at the present time: I don't think history will treat Henry Kissinger very kindly.

Senator **Laxalt**. He was not treated very kindly yesterday apparently.

Mr. **Carpenter**. I think it is beginning to set in.

Senator **Garn**. He only finished ninth out of nine.

Senator **Laxalt**. That is not bad.

Do we have any other observations or questions?

MOBILE ICBM SYSTEM

Mr. **Carpenter**. Could I make one observation, sir. I would like this on the record for a very basic reason, although it is an aside here. You gentlemen asked why we do not have a mobile ICBM and why we are not seriously developing such a weapon system. Colonel Montulli gave us a good answer. We are currently fortunate to have Gen. Lew Allen as Air Force Chief of Staff. He has immense experience and knows the current technological base of this country very well. I know it less well. You should levy on General Allen, through whatever authority, this task: At one-tenth of the MX cost, define the development and deployment of a road-mobile ICBM system that must have several hundred missiles fully operational prior to the current MX IOC of 1986. Assuming that my calculations are correct, we could have less than 100 MX warheads surviving a concerted Soviet attack. The road-mobile ICBM would give us four times that survivability in one-third of the time and one-tenth of the cost. If you charged him to do that, I am certain General Allen and the Air Force are resourceful enough to come up with an answer.

Senator **Laxalt**. That is an interesting challenge. We thank you very much. It has been a most interesting afternoon. We appreciate it greatly.

SUBCOMMITTEES RECESS

The subcommittees will be in recess until tomorrow morning at 10 o'clock when we will hear other expert testimony on the MX basing mode.

[Whereupon, at 4:10 p.m., Thursday, June 18, the subcommittees were recessed to reconvene at 10 a.m., Friday, June 19.]

MX MISSILE BASING MODE ALTERNATIVES

FRIDAY, JUNE 19, 1981

U.S. SENATE,
SUBCOMMITTEES ON MILITARY CONSTRUCTION
AND DEPARTMENT OF DEFENSE,
Washington, D.C.

The subcommittees met at 10 a.m. in room 1223, Everett McKinley Dirksen Senate Office Building, Hon. Paul Laxalt (chairman, Subcommittee on Military Construction) presiding.

Present: Senators Laxalt and Garn; also present: Senator Hatch.

NONDEPARTMENTAL WITNESSES

HEARING PROCEDURE

Senator **LAXALT**. The subcommittees will come to order.

This morning we are beginning the third and final day of hearings on basing mode alternatives for the MX missile system.

We are pleased to welcome our witnesses today—

Sidney D. Drell, deputy director, Stanford Linear Accelerator Center, Stanford University, testified before our subcommittee last year and has returned today to discuss his proposal to deploy the MX on small submarines—the SUM proposal; and

John E. Draim, a retired Navy captain with many years of experience in the research and development field, is returning to testify as he did last year on the "hydra-launch" proposal for the MX.

We will also place a statement in the record from our distinguished colleague from Michigan, Senator Levin.

We will begin with Mr. Drell.

Mr. Drell, we wish to welcome you as I indicated in the formal remarks. What I would like and what Senator Garn would like, in view of the fact that we do have somewhat of a time press this morning, is for you, if you will, to update the presentation you made last year very effectively and tell us whether anything has developed additionally; and also you are as aware as I am of the criticism that has been leveled to your proposed plan. If you can meet those point by point.

Senator Garn, do you have any question or observation?

Senator **GARN**. I have not, Mr. Chairman.

PREPARED STATEMENT

Senator **LAXALT**. Before we proceed to hear Mr. Drell's testimony, we will place in the record at this point his prepared statement and an abstract to the statement.

[The statement and abstract follow:]

PREPARED STATEMENT OF SIDNEY D. DRELL, DEPUTY DIRECTOR
STANFORD UNIVERSITY LINEAR ACCELERATOR CENTER

TESTIMONY ON BASING THE MX AT SEA ON SMALL SUBMARINES:
THE SUM SYSTEM

Thank you very much for the opportunity to appear once again before these subcommittees and to present my views on a survivable and effective basing system for the new MX missile. In my testimony before you a year ago* I advocated basing the MX at sea on small submarines - i.e., the Smallsub Underwater Mobile (SUM) system. Since then this concept of basing the MX at sea in capsules, mounted horizontally, external to the pressure hull of small submarines that are deployed near the U.S. coastlines has been developed much further by extensive technical analyses. In particular, I led a 1980 JASON Summer Study on SUM that was performed at the direction of the Undersecretary of Defense for Research and Engineering. This study provides the technical basis for my testimony today. However, I am here today as an individual and represent no official views in my advocacy of SUM as a preferred and effective basing scheme for the MX. In particular, the JASON study was strictly a technical analysis and does not advocate any one basing mode. It was reviewed for technical content and issued as an official JASON report,** classified as Secret.

I am also appending my curriculum vitae to my written statement to the hearings. It lists my present and past activities over a period of 21 years of work on national security programs of the United States as a consultant to various offices and departments of the United States government. Of particular relevance, I am currently a consultant to the Senate Select Committee on Intelligence, to the Congressional Office of Technology Assessment, and to the U.S. Defense Department.

I. Basic Assumptions

1. It is not an acceptable policy for the United States simply to

---

*"Testimony On Sum as a Basing Scheme for the MX and its Advantages Relative to the Racetrack" before Defense and Military Construction Subcommittees of the Senate Appropriations Committee, May 7, 1980.

**Technical Report JSR-80-03, September 1980, "Smallsub Underwater Mobile Basing of ICBM's" (U).

ignore the growing threat to our fixed land-based ICBM force of 1000 Minutemen and 53 Titan II missiles. The argument supporting this statement was presented in my testimony of last May. The issue before the nation is not whether - but how - to respond to the growing Soviet ICBM threat to the U.S. land-based ICBM force.

2. It is desirable for the United States to maintain a broad diversity of strategic nuclear deterrent forces with different operational characteristics, and potential vulnerabilities and failure modes.

II. The MX Multiple Protective Shelter (MPS) System is Seriously Deficient

A fixed, land-based multiple protective shelter (MPS) deployment of the MX is not a satisfactory response for the U.S. to the growing threat to our land-based ICBM's. The principal deficiencies of an MX/MPS that lead me to this conclusion are the following:

1. It will be predictably vulnerable by the time it is deployed. It is characteristic of any fixed multiple aimpoint system, such as the MX/MPS, that it is sensitive to the numbers of threatening Soviet warheads. In particular, the total number of shelters must exceed the number of threatening warheads for us to have confidence in the survivability of a finite portion of the deployed missiles. Currently the U.S. plans assume survival of 100 of the 200 MX's being deployed. However, in sizing the total system as 200 linear grids with 4600 shelters (each grid containing 23 shelters, one genuine 10-warhead MX missile and 22 high quality dummy missiles) the U.S. must be able to forecast accurately the number of threatening warheads the Soviets will be deploying. In particular, the SALT II restraints on numbers of warheads per missile, as well as on total numbers of missiles, are required in order to plan the number of shelters we will have to deploy. In the absence of current or future SALT limits on the maximum number of threatening Soviet warheads, a multiple aimpoint system has no assurance of catching up with the threat. It may lead to nothing more than an open-ended race between Soviet warheads and U.S. concrete shelters.

The recent study* by OTA, the Congressional Office of Technology

---

*The results were presented in an unclassified briefing on "MX Missile Basing" to the Subcommittee on Public Lands and National Parks of the House Committee on Interior and Insular Affairs, March 10, 1981. The OTA study assumed that a constant ratio of one MX missile per 23 shelters was maintained.

Assessment, has estimated that the U.S. would be required to increase the presently planned deployment of the MX/MPS by 80% (from 4600 to 8250 shelters, from 200 to 360 MX missiles, and from 4400 to 7890 decoys) in order to maintain an expected survival of 100 MX missiles in 1990 if the Soviets simply continue the 1970's trends in their ICBM deployments (and without either major break-throughs in ICBM technology or constraints on their programs imposed by shortages of critical nuclear materials). The projected 1995 Soviet threat under these same assumptions would require some 12,500 shelters with 544 MX missiles and 11,956 decoys. I do not see such a prospect as being in the U.S. interest. I am confident that U.S. military technology has more to offer our citizens than paving valleys of Nevada and Utah with concrete in response to the Soviet challenge.

2. Survivability of the MPS depends on the new and high risk technology and operational requirements for maintaining preservation of location uncertainty (PLU) of the missiles versus the many decoys. A missile has many observable signatures, viz. optical, nuclear radiations, total mass, mass vibration characteristics while in motion, heat or IR radiations, electromagnetic and chemical signals, and a magnetic signature due to the high quantity of ferrous material. Each of these signatures of a missile must be reproduced faithfully in each of the 4400 decoys in order to maintain PLU from highly sensitive sensors, available with today's technology, that may be emplaced near the roads and shelters.* It will be possible to gain confidence in an effective PLU technology only after successful full scale tests can be carried out on an actual deployment. Furthermore, it is also essential to preserve secrecy and effective compartmentalization of critical information about the location of missiles versus decoys among the large staff of technical and military personnel who will operate the MX/MPS while living amidst the populations of Utah, Nevada, and environs. Since one can never be certain of success in maintaining PLU, and failure would be catastrophic, pressures will

---

*Alternatively, one could consider jamming the sensors. Maintaining an effective PLU would be even more difficult if an ABM system were to be included with the MX/MPS.

inevitably grow to tighten the security requirements, to expand the local security areas around the system and to expand counterintelligence efforts in order to maintain a viable system.

3. With such a system it is a question of "all or nothing." It is clear from Figure (1) that anything less then the full deployment of the MX/MPS system, even against an accurately projected threat that is limited by SALT treaties, present and future, is of little real value to the U.S. Only when the MX/MPS deploys more aimpoints than the number of threatening warheads - i.e., only after the first half of the system is deployed - do we even begin to realize an appreciable gain in retaliatory capability, as measured by survivable megatonnage.

4. ICBM's that are deceptively based on land will add new difficulties to our ability to verify limitations on force deployments. This contributes neither to our security nor to prospects for future progress in verifiable arms control. Specific features in the original design of the MX/MPS system, such as barriers on access roads and removable plugs in ceilings of shelters and assembly buildings to allow periodic satellite viewing, were introduced as verification aids. The requirement to establish some such agreed, cooperative operational procedures is vital to U.S. security interests if the Soviet Union also deploys deceptively based ICBM's on land, as their response to the extensive countersilo threat against their current force of fixed ICBM's that will be posed by the 2,000 very accurate MIRV's on our 200 MX missiles. If they go this way - either with an MPS system of their own or with a mobile ICBM (perhaps resurrecting their now-dormant SS-16 program) - we will be competing with the Soviets on turf where they have the advantage. It is a more difficult problem for the United States to have confidence that the Soviet Union is not violating deployment ceilings than vice versa. I find it difficult to imagine an advantage for the United States with its open society in competing with the closed Soviet society to maintain secrecy and deception.

The Soviet system is far better adapted to the imposition of controls, secrecy, and limitations on its population; and they have a much larger land mass in which to deploy and "hide" mobile or deceptively based

ICBM's. We should prefer to compete with the Soviets on our own home turf of mobility and agility based upon new systems and reliable technologies.

The question is: "Can we do better than MX/MPS?" My answer is: "Yes, indeed, by going to sea with a fully mobile basing of the MX."

III. Advantages of Basing the MX at Sea on Submarines

Sea-basing the MX on submarines avoids these four deficiencies of the MX/MPS:

1. Mobile submarines moving invisibly under the ocean's surface are currently survivable and are predictably survivable for the foreseeable future.

2. A submarine based deployment does not require developing any risky new technologies or procedures, but builds on existing currently successful practices. At the same time it is possible to introduce very different operational characteristics from the existing Poseidon/Trident force in order to prevent the Soviet Union from concentrating its anti-submarine warfare (ASW) efforts against one system only. These differences include deploying many small submarines with reduced observables and operating in new ocean areas near to U.S. shorelines.

3. Each additional submarine adds incrementally to the survivable megatonnage. To a good approximation its "value" is proportional to the buy which can be readily adjusted in accord with possible future changes in the strategic needs of the U.S.

4. Submarine deployments can be monitored in accord with currently agreed procedures developed at SALT II for counting and verifying launchers.* Submarine construction at present is verified by national technical means - i.e., satellite observation.

---

*In contrast to the provisions of the interim SALT I agreement which limited the number of submarines, SALT II limits only the number of missile tubes, which are added into the count of launcher numbers subsequent to the completion of sea trials.

IV. Description of SUM*

The Smallsub Underwater Mobile (SUM) system is a specific sea-basing proposal that constitutes an effective, timely, and economical response to the Soviet threat. It retains the major desirable characteristics of the current ICBM force and therefore preserves a healthy diversity in the U.S. strategic deterrent.

SUM would be a deployment of small non-nuclear-powered submarines operating within 500-1000 nautical miles (nmi) of the continental United States and in the Gulf of Alaska. Figure (2) shows the suggested deployment areas. This concept can be adapted to a wide variety of missiles with ICBM range, but we assume that each submarine will carry two encapsulated MX missiles mounted horizontally, external to its pressure hull. Limited operating range, short mission duration (initially no more than four weeks), and a small crew (of about 20 to 25, consistent with safe, efficient operation aided by automation) make possible the concept of small submarines with hull displacements of no more than about 1,200 tons. The total displacement of a SUM boat carrying two encapsulated missiles is about 1,700 tons. This is comparable to World War II submarines and about one-tenth the size of the new Trident missile submarines.

SUM consists of four subsystems: the encapsulated MX missile itself; the submarine carrying the missile; the missile guidance system; and specialized command, control, and communications to the vessel.

The primary function of the crew would be to maintain sovereignty over the nuclear-armed missiles; guard against piracy, sabotage, and interference; perform safety checks and maintenance; and, of course, operate the submarine. Full power of decision to launch the missiles would reside with the President (or his successor as national command authority), and orders would be transmitted by encrypted communication to the missile. The submarine commander would retain veto power in the event of a failure, as indicated by on-board instrument checks.

With their limited range and duration, SUM submarines have very modest power requirements, and therefore nuclear propulsion is not necessary. Various (relatively inexpensive) propulsion schemes are feasible, including diesel-electric and electric-drive fuel-cell systems. We foresee an initial operation with familiar, tested diesel-electric power, with the submerged submarines patrolling at a speed of about four knots. As in all modern diesel-electric submarines, air would be taken in through a conventional "snorkel" tube for a few hours each day to operate the diesel engine to recharge the battery. This system could evolve in the mid-1990s to one that utilizes fuel-cell propulsion, thereby avoiding any need to snorkel. The technology of fuel-cell propulsion has been extensively tested, but at-sea use of the required fuel and oxidizer still requires further development.

---

*This section is adapted from the article "Basing the MX Missile: A Better Idea" by Sidney D. Drell and Richard L. Garwin that appeared in Technology Review, May/June 1981.

A conservatively designed SUM boat (state-of-the-art for missile capsule and hull) operating at a 200-to-300-foot depth in deep water would be safe from the shock effects of a 1-megaton detonation at distances greater than four nautical miles. By this criterion, more than 20,000 megatons - a number that far exceeds the total Soviet arsenal - would be required to barrage a total SUM deployment area of 1 million square nautical miles. And further fractionation (MIRVING) of their ICBM force would not increase the threat to SUM.

The SUM force can reliably achieve high accuracy comparable with that envisioned for the land-based MX. To correct errors in flight parameters, the missile would receive radio signals during the boost from the Navstar-satellite global positioning system (GPS) or a network of onshore transmitters forming a ground beacon system. Line-of-sight contact with a large and inexpensive network of such beacons could be achieved for submarine launches as far as 500 miles offshore. The duration of missile flight in radio line of sight with ground stations and below ionospheric regions would be sufficiently long that this information would not be distorted by high-altitude nuclear detonations. The ground stations would consist of many unmanned, relatively inexpensive transmitters supplemented by even more inexpensive decoys, and would be turned on only if Navstar were destroyed, minimizing system vulnerability to enemy attack. The SUM submarines themselves would not need a good inertial navigation system but would rely on the very capable guidance system of the MX for accurate locational data, supplemented with occasional radio signals.*

---

*At only a slightly increased expense, one can add to the MX a star tracker which has been developed by the navy for improved accuracy of its sea-launched ballistic missiles (SLBM's). With a star tracker augmentation, the Navstar or ground beacon system need be used only for a short time to provide accurate position and velocity information. The alignment of the missile guidance platform would then come directly from the star tracker information.

The current U.S. submarine missile force has a robust and redundant command, control, and communications system, but it is ordinarily viewed as providing less confidence and security than the bomber and land-based ICBM components of the triad. These reservations do not apply to SUM. Because of its coastal deployment, SUM need not rely only on world-wide communication networks. Existing very-low-frequency (VLF) transmitters can be supplemented by equipment at dispersed survivable ground stations or by airborne transmitters much less powerful than those now carried by the navy TACAMO (take-charge-and-move-out) aircraft. Ultimately, other means of communication are available, such as ultra-high frequency (UHF) from satellites, with improved techniques for receiving these communications as well. For example, a system of expendable buoys has been proposed for SUM and other submarine-launched ballistic missile systems. A new buoy would be ejected every few hours from the submarine and float awash, while the submarine paid out a fine, slack, insulated wire or fiber-optic thread to receive the signals relayed by the buoy.

The SUM system would maintain about 55 boats with 110 missiles at sea, corresponding to the design goal of survivable warheads for the proposed land-based MPS deployment of MX. Although SALT II would limit any land-based MX to 10 MIRVS, it would permit submarine-launched ballistic missiles to have up to 14 warheads per missile, and the SUM-MX could carry 11 to 14 assorted Trident I and Mk-12A warheads.

The encapsulated MX missile makes it possible, as foreseen in the massive Defense Department strategic systems study (STRAT-X) of the 1960's, to provide a clean interface between missile and submarine. Figure (3) shows the exterior of the submarine.* With the missile control center and sophisticated inertial navigation system contained in the missile and capsule, the submarine is a simple electrical relay center for radio signals. These are transmitted from the submarine directly to the missile capsule, where the signal is decrypted and, if verified, launching takes place.

The actual launch consists of freeing the capsule from the submarine, pushing on the capsule with the expulsion actuator to give it a horizontal velocity of a few feet per second, and blowing water from "soft tankage" in the front of the capsule by means of a contained gas generator. The capsule then becomes buoyant* and accelerates through the surface of the water. As the capsule broaches, explosive cutters free the forward and rear dome-retaining clamp bands. The missile booster then fires, and the missile emerges from the capsule as from a normal land launch. A gas generator in the capsule then inflates an airbag so that it cannot sink and collide with the submarine. The submarine refairs to its initial shape by inflating a rubberized fabric with seawater.

---

*A capsule of approximately 3.4 meter diameter, housing a missile of 2.3 meter diameter is strapped to a submarine of approximately 6.1 meter diameter.

V. Changes in SUM Design

The SUM system described above has evolved in several aspects from the one originally described prior to the two extensive technical studies carried out by JASON and for the Navy** in 1980. The most significant of these changes are the following:

1. Proposed operating areas have been increased to ranges of 500-1000 nautical miles (nmi) from operating bases, including the Gulf of Alaska, rather than being restricted to within 200 nmi of the continental U.S. The reason for this is primarily that it provides greater flexibility of operations without a significant increase in cost or of system complexity. The new operating area of up to two million square nautical miles is much larger than the minimum required to avoid any danger of being barraged by the entire Soviet megatonnage. The originally proposed deployment area of one-half million square nautical miles was also substantially larger than could be barraged.

2. The SUM boat has been increased in size to one with a submerged displacement, including the missile capsules, of roughly 1700 tons. The original proposal described a system of boat plus two missiles displacing only 1000 tons. For the larger submarine, the crew size has been increased from a minimum of 15 crew members, as originally proposed, to a crew of 20-25. These changes in size only have a limited impact on the

---

*Many problems are avoided by carrying a neutrally buoyant capsule rather than one that is positively buoyant. Thus, no reballasting of the submarine after capsule ejection is required. There is no need for large hard tanks to prevent loss of the submarine if a capsule floods, because the capsule can be ejected if flooded. The required resistance to shock loading is obtained for the submarine-capsule structure by the arrangement of liquid springs, hydraulic pistons, and multiple retaining bands.

**"An Assessment of Small Submarines and Encapsulation of Ballistic Missiles," SPC554, May 1980.

system investment and operating costs while at the same time allowing for greater operational flexibility and a future growth potential to missions of longer durations. Allowance is also made for loading defensive equipment on the submarines.

3. Diesel-electric propulsion is envisaged for Phase I of the SUM deployment, with conversion to fuel-cell propulsion, which removes the need of the submarine to snorkel, coming later, if desired, in the 1990's at the time of normal system overhaul. This change is made on the basis of the analyses showing that there is only a very limited potential threat to a snorkeling SUM system for the coming decade. We are therefore proposing to use standard, already developed diesel-electric propulsion for SUM, but recommend advanced development of fuel-cell propulsion as a hedge against unforeseen growth in the threat.

The net effect of these changes is that the system we are proposing is more in keeping with currently developed technologies for submarine sizes and propulsion and for automated controls and data handling. In particular, there already exist in Sweden and in West Germany diesel-electric submarines and designs comparable to what is being proposed here. Furthermore, the larger boats and operating areas now proposed provide SUM with considerably more flexibility for responding to hypothesized, although presently unforseen and unknown, Soviet anti-submarine warfare (ASW) threats of the future.

VI. Fiction about SUM

CHARGE: SUM is vulnerable to a tidal assault by underwater nuclear explosions. This is known as the van Dorn effect, i.e., the creation of extremely high ocean waves in shallow water by large explosions at a distance in deep water. This effect is a threat to the survivability of submarines in shallow water on the Continental Shelf shoreward of the explosion. In such coastal waters of depths less than 600 feet there could be serious turbulence generated by massive nuclear detonations further off shore which could tumble and destroy submarines.

RESPONSE: SUM is not proposed for deployment in such shallow waters on the Continental Shelf. These shallow areas constitute no more than 15% of the originally proposed deployment for SUM within a strip of 200 nautical miles width along the coast of the continental U.S. They constitute less than 5% of the more extended deployment area currently proposed. Although it is frequently described as such by its critics, SUM never has been proposed as a Continental Shelf sitter. There is thus no significant vulnerability of SUM to the Van Dorn effect. On this point there is no disagreement between SUM advocates and the top responsible and knowledgeable Defense officials. The senior technical Defense officials concerned with the MX basing problem from 1977-81, Dr. William Perry, the Undersecretary of Defense Research and Engineering, and his deputy, Dr. Seymour Zeiberg, have confirmed directly that they recognize no such vulnerability either. The record on this is clear and is in the official record of the Senate debate on the Department of Defense Appropriations for FY 1980 (see Congressional Record, Senate S-16353, November 9, 1979), as well as in Hearings of the Defense and Military Construction Subcommittees of the Senate Appropriations Committee, May 7, 1980.*

CHARGE: One cannot achieve ICBM accuracy with a sea-based MX. Recently the charge that submarine-based missiles have difficulty obtaining the accuracy that is possible with land-based missiles was attributed to the Secretary of the Navy, John Lehman, in an Associated Press wire story that appeared on April 8, 1981 in the LAS VEGAS REVIEW-JOURNAL.

RESPONSE: As I stated earlier, it is, in fact, possible with a sea-based system to achieve accuracy that is comparable with land-based ICBM's with the help of external navigational aids such as a ground-beacon system or the satellite-based Navstar system. These can be supplemented further by a star-tracker. This conclusion is affirmed in the OTA study and also in the Navy study. The fact that our sea-based missiles currently do not achieve the same accuracy as do the land-based ICBM's is due solely to the fact that the effort has not been made to improve the accuracy of the SLBM's. There is no technical obstacle to doing so, as has been shown in these studies. On this there is no disagreement with top defense officials, such as Dr. William Perry. In an interview appearing in SCIENCE on February 13, 1981, Dr. Perry stated that "You cannot give strictly technical arguments" as to why we couldn't "give up on the land-based missiles and expand our submarine missile force." His preference for the MX/MPS system was defended as "much more a policy consideration than a technical consideration." Moreover, on purely technical grounds, SUM, like all sea-based systems, has the important advantage that operational missile firing tests can be performed over a wide range of coordinates and directions. In this way unknown errors or biases that remain hidden in tests performed only over east-west directions, as for ICBM's launched from Vandenberg Air Force Base, can be detected and corrected if present. This is an important advantage for sea launched ballistic missiles when it comes to establishing confidence in accuracy.

---

*However, this false allegation still appears in the press. For example, in his NEW YORK TIMES column on January 19, 1981, Drew Middleton quotes "a senior Air Force officer" as alleging that a SUM deployment would be vulnerable because "one nuclear explosion at sea would cause a tidal wave that would tumble those submarines onto their backside."

CHARGE: One will not have as good command and control of the sea-based missiles as can be achieved with the land-based ICBM's.

RESPONSE: This is again false. There may, indeed, be some comfort in, or nostalgia for, weapons based on U.S. sovereign soil that can be controlled by hard ground-lines of communication prior to an enemy's nuclear strike. However, such means cannot be relied on after the initial Soviet strike has arrived. In order to launch a retaliatory second strike, there will be no greater difficulty in communicating from our airborne launch control centers to a SUM force 500 miles off our shorelines than to a debri-laden MX field in Nevada and Utah. Indeed, with airborne command posts, as currently exist, and with a variety of communication links there is no distance or horizon problem for confident and responsive communication with SUM. As with the accuracy issue above, the technical differences between command and control of land and sea basing of missiles are relatively minor - and rapidly diminishing further.

CHARGE: Land-based ICBM's have a unique strategic property of instant readiness that cannot be achieved by a sea-based force.

RESPONSE: Instant readiness can be achieved by the SUM system just as for the ICBM's. The missile launch command will be transmitted directly to the missile from the National Command Authority, as has already been described. The submarine is continually in a receive-mode for communication. It can also respond securely and confirm launch by transmission over the relatively short distance from the submarines to shore-based receivers. Indeed, the SUM system supplements the Trident force in several ways that are specifically characteristic of ICBM's. One that is particularly relevant for low-level engagements is the fact that with each missile launch the position of only one other missile is disclosed - and not of 23 as is the case for Trident.

CHARGE: It will take longer to deploy a SUM system than the MX/MPS and therefore SUM is not a timely response to the threat. In fact some defense analysts have alleged that construction of a naval base for berthing, maintaining, and resupplying a portion of the SUM force (one-third, if 3 bases are built) would take more than 12 years.

RESPONSE: There is no technical support for this claim. In general it is difficult to argue differences of time scale to construct large and complex systems. Their construction times can be grossly affected by administrative arrangements, by the will of the people and the willingness of government to provide necessary support, even if there is no technical reason for delay.

Our own analysis based on conservative practice (allowing 7 years until deployment of the first SUM boat) leads us to conclude that initial system deployment can be realized by 1988, with full deployment completed by 1992. In comparing this deployment schedule with that of the MX/MPS it is important to realize that each SUM boat deployed contributes to survivable megatonnage for the U.S. deterrent. This is not the case for the MX/MPS, which, as we saw in Figure (1), will add significantly to the survivable U.S. megatonnage only when it presents so many targets that they cannot all be destroyed. Hence it is the time until completion of most of the shelters that must be compared with the initial deployment of SUM. The current MX/MPS schedule calls for initial deployment in late 1986, with full deployment by 1990. However, this schedule is threatened by serious delays; in particular litigation by citizens' groups in Nevada and Utah over this huge project's environmental impact, both from construction and operation, will surely delay the completion date. Thus SUM is likely to be a more timely response to the problem of Minuteman vulnerability than is the MX/MPS, and it has a relatively modest environmental impact, particularly if its initial deployment is at an existing naval base.

Concerning the time to build SUM, I quote Admiral Thomas Moorer, former Chief of Naval Operations and Chairman of the Joint Chiefs of Staff, addressing "A Seminar on MX Basing" organized by the Congressional Research Service on March 23, 1981:

> "The bottleneck is in the nuclear powered construction, where you have to have an entirely different hull and the nuclear power plant. There is enough steel and shipyard capacity to build the

> kind of submarine he's (Drell) talking about at an accelerated pace. And it wouldn't begin to take seven years to build one of them."

In considering the number of years required till initial deployment of SUM it is of interest to recall the history of the Polaris project. Less than 4 years were required to proceed from the existence of a nuclear powered attack submarine (SSN) in 1957 (the Nautilus, commissioned in 1955, was the first SSN and itself took less than 5 years to complete) to a deployed fleet ballistic missile boat (SSBN) in November 1960. Indeed, by the end of 1960, 4 years after initiation of the Polaris project, two SSBN's were on patrol and 12 were in various stages of outfitting or construction. Major technical accomplishments during that short period included solid fuel missiles with adequate thrust for a 1200-mile range and the technique for launching missiles from submerged submarines. The hull of an SSN was "cut open" and redesigned in this period to accommodate the 16-tube missile mid-section. The entire nuclear submarine revolution from the 1949 go-ahead for the Nautilus given by the Chief of Naval Operations to the deployment of the first Polaris SSBN boat in 1960 required only 11 years! More recently however the Trident submarine construction program and other large military construction programs have not done so well.

CHARGE: SUM will be more expensive than the MX/MPS.

RESPONSE: There are, of course, great uncertainties in attempting to develop accurate cost figures for investment plus operations for such large and complex defense systems, projecting more than 10 years into the future. Nevertheless, cost differences can be assessed with greater confidence because they are computed on the basis of the same set of assumptions. In this context, SUM is estimated to be at least $10 billion less expensive than the MX/MPS for deploying and operating 850 survivable and effective warheads. In arriving at this result one must assume that SALT II will limit the number of threatening Soviet ICBM warheads. Otherwise, the MX/MPS deployment would be even larger and more expensive or require an active and costly ballistic missile defense (in conflict with the SALT I treaty limiting such deployments) in order to meet the same criterion of survivability.

More specifically, a SUM system consisting of 72 submarines, each with 2 MX missiles (but buying 250 missiles and capsules), 1,000 ground-based navigational transmitters, and 3 SUM operating bases, would cost less than $30 billion. This includes submarines with a considerable potential for growth in mission duration, propulsion systems, and the like. Their displacements are about 1,700 tons, including the allowance of 50 tons for defensive systems. The $30 billion also includes full cost of operation for 10 years. A lower-cost system adding up to approximately $22.4 billion could be obtained by deploying larger submarines, each bearing four missiles, and building only 2 operating bases instead of 3 for the 36 boats. SUM will not only be less vulnerable, less obtrusive, and less threatening to arms control but less costly as well.

CHARGE: SUM would have no advantage relative to the Trident force. It would mean abandoning the triad in favor of a less desirable dyad and, by putting too much of our deterrent at sea, making it potentially vulnerable to the possibility that the "oceans will become transparent."

RESPONSE: There are major differences, both technical and operational, between SUM and Trident with respect to antisubmarine warfare. Operational advantages include the very much larger number of SUM boats at sea, which gives SUM a major edge against any attempt at continuous trailing of the entire force. Moreover, SUM's proximity to U.S. shores would not concede a benign operating environment to Soviet antisubmarine forces; U.S. naval assets could obviously be used more extensively and aggressively. Physical advantages of the SUM boats include their relative silence (because of electric-drive propulsion) and their much smaller size and, hence, reduced observables relative to Trident. On the other hand, the Trident submarines have the advantage of a much larger operating area - roughly 17 million square miles as opposed to one to two million - and they don't have to snorkel.

The near-coastal waters of the SUM deployment are a complex operating medium for antisubmarine warfare, which relies, at present, almost entirely on acoustics. Much of these waters are acoustically "shallow": they do not support long-range propagation of low-frequency sonar without loss of signal from repeated bounces off the ocean bottom. Moreover, the SUM deployment area can readily be filled with decoys and noise generators, making the quiet submarines even more difficult to find (although submerged diesel-electric submarines are regarded as virtually impossible to detect).

However, diesel-electric submarines may also be detected by radar while at the surface. This raises the possibility that a fraction of the SUM force could be vulnerable to future Soviet antisubmarine capabilities. If it should emerge as a threat to SUM, this concern could be addressed by eliminating the need to snorkel - converting to fuel cells for submarine propulsion. This option should be available in the mid-1990s and could be implemented as individual boats are overhauled.

Both Trident and SUM will be highly survivable for the foreseeable future. In an era in which "stealth" technology is supposed to render our aircraft unobservable to radar, it is certain that analogous techniques could help hide submarines. Vice-Admiral Charles H. Griffiths, commander of the U.S. Submarine Force, recently commented in an interview appearing in the LOS ANGELES TIMES on September 13, 1980, that the oceans are a great place to hide because "they're becoming more opaque as we understand more about them."

VII. The Advantages of SUM Plus Trident

SUM is not a substitute for or a competitor of Trident submarines. The United States is committed to the Trident submarine construction program, which should be strengthened and expedited to ensure its success. I advocate a mixed deployment of SUM plus Trident because their operational and physical differences insure a broad diversity of our sea-based deterrent. In fact, deploying SUM means quite the opposite of reducing our deterrent from a triad to a dyad. If the U.S. maintains a constant total number of deployed launchers in our strategic forces, most of the current Minuteman ICBM force would be retained along with SUM. Our deterrent would, indeed, be built of four different components: Bombers with air launched cruise missiles, SRAM's, and gravity bombs, Minuteman ICBM's, Trident/Poseidon, and SUM.

I have described technical advantages in deploying SUM, together with Trident, rather than the MX/MPS. There are also important policy questions such as "Are there important political advantages to expanding and modernizing the land-based ICBM force?" I believe the negative answer to this was well expressed by Admiral Moorer at the March 23, 1981, Congressional Research Service seminar:

> "I do not see that providing the Soviets with a big fat target which will create an astronomical amount of fallout, which will then drift over the Chicago-Boston-Washington triangle and kill millions and millions of Americans is a very sound way of providing defense."

In a similar vein, Rear Admiral George H. Miller, USN (Ret), wrote in SHIPMATE last December:

> "Good strategy arranges for battles to be fought elsewhere than in the land one seeks to preserve and defend."

Citing a football analogy, Admiral MIller suggested (letter to the WASHINGTON POST, August 1979) that one should "never be caught with the football in your own end zone."

VIII. Summary and Recommendations

There is no technical obstacle to putting MX to sea in a SUM deployment that is survivable, effective, and meets the essential goals of the MX/MPS program. SUM also is a deployment that poses no new verification difficulties for arms control.

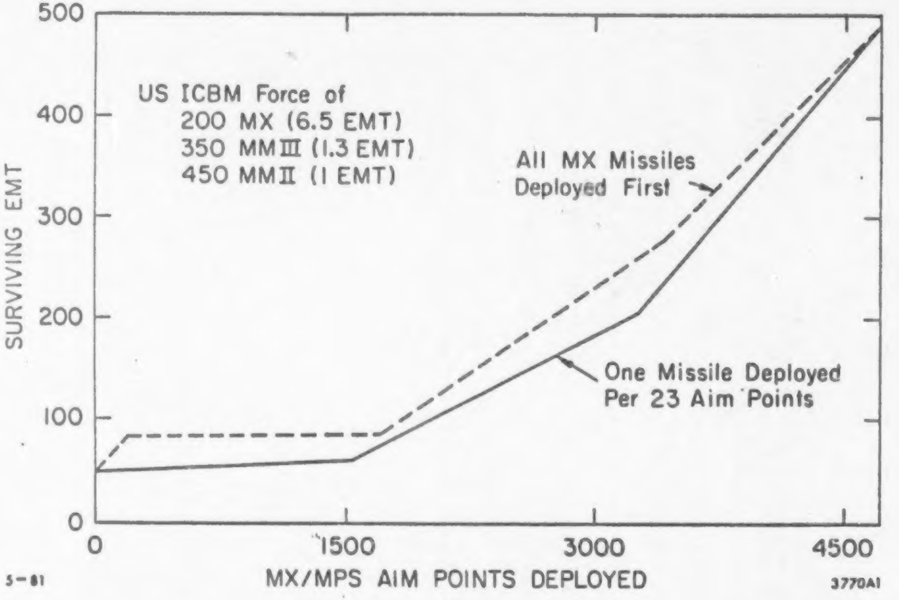
In contrast to the MX/MPS, SUM will add effectively to the U.S. survivable megatonnage whether deployed in part or in full. The survivability of SUM is not sensitive to the Soviet ICBM threat, and its level of deployment can be adjusted in accord with progress and prospects in arms control negotiations.

In recommending the SUM basing of MX I would like to record my priorities for defense programs designed to address the security needs of the United States in the coming decade. In order, they are

1. Strengthen our conventional (non-nuclear) forces by improving their readiness and effectiveness with troop training and needed equipment modernization.
2. Improve our command, control, communications, and intelligence (C^3I) capabilities, and thereby the overall effectiveness of the existing deterrent forces.
3. Expedite and strengthen the Trident submarine construction program with effective management and budgetary support. One Trident boat at sea adds as much to the survivable U.S. retaliatory force as would all of the first half of the MPS deployment. (See Figure 1.)
4. Modernize the bomber component of our strategic forces by expediting and completing deployment of the air-launched cruise missiles (ALCM's) and by developing a modern bomber. This need not be a penetrating bomber against the stacked Soviet air defenses, but a general purpose bomber capable as a platform for launching ALCM's and SRAM's and capable for a variety of potential missions in other regions with vital U.S. interests.
5. Initiate the SUM program as a valuable technology for diversifying and strengthening our sea-based deterrent. The ultimate mix of SUM and

Trident forces, as well as their total level of deployment, can be adjusted during the coming decade to meet the policy goals of the United States as they evolve in response to the challenge and to possible progress in the arms control dialogue, particularly with the Soviet Union.

The first four of these recommendations address today's recognized needs and problems. The SUM program in Recommendation 5 will show that the U.S. is determined to maintain a strong nuclear deterrent based on survivable and effective nuclear forces for the foreseeable future. We may hope that the immediate future will also bring evidence of determination and success on the part of the major nuclear powers in their efforts to diminish the dangers of nuclear holocaust and to reduce the already greatly excessive levels of nuclear missiles and megatons in their arsenals. It is impossible to overestimate the importance of resuming an arms control dialogue leading to genuine progress toward these vital goals.



MX/MPS SURVIVABILITY

Figure 1

MX-MPS Survivability. It is assumed that 5,000 Soviet RV's, each with a destruction probability of 0.8 against a silo or shelter, are used against the U.S. ICBM force. EMT defines the effective megatonnage. The Minuteman II missiles are assumed to have 1-megaton warheads, the Minuteman III to have 3 MIRV's, each of about 200-kiloton yield, and the MX to have 10 warheads of about 400-kiloton yield. The effectiveness of a warhead against large targets is determined by the ground area subject to destructive overpressure, while that of a highly accurate force against silos is determined only by numbers of warheads. Thus, the EMT of a force is obtained - as a compromise - by summing the megatonnage of each warhead raised to the 0.5 power.

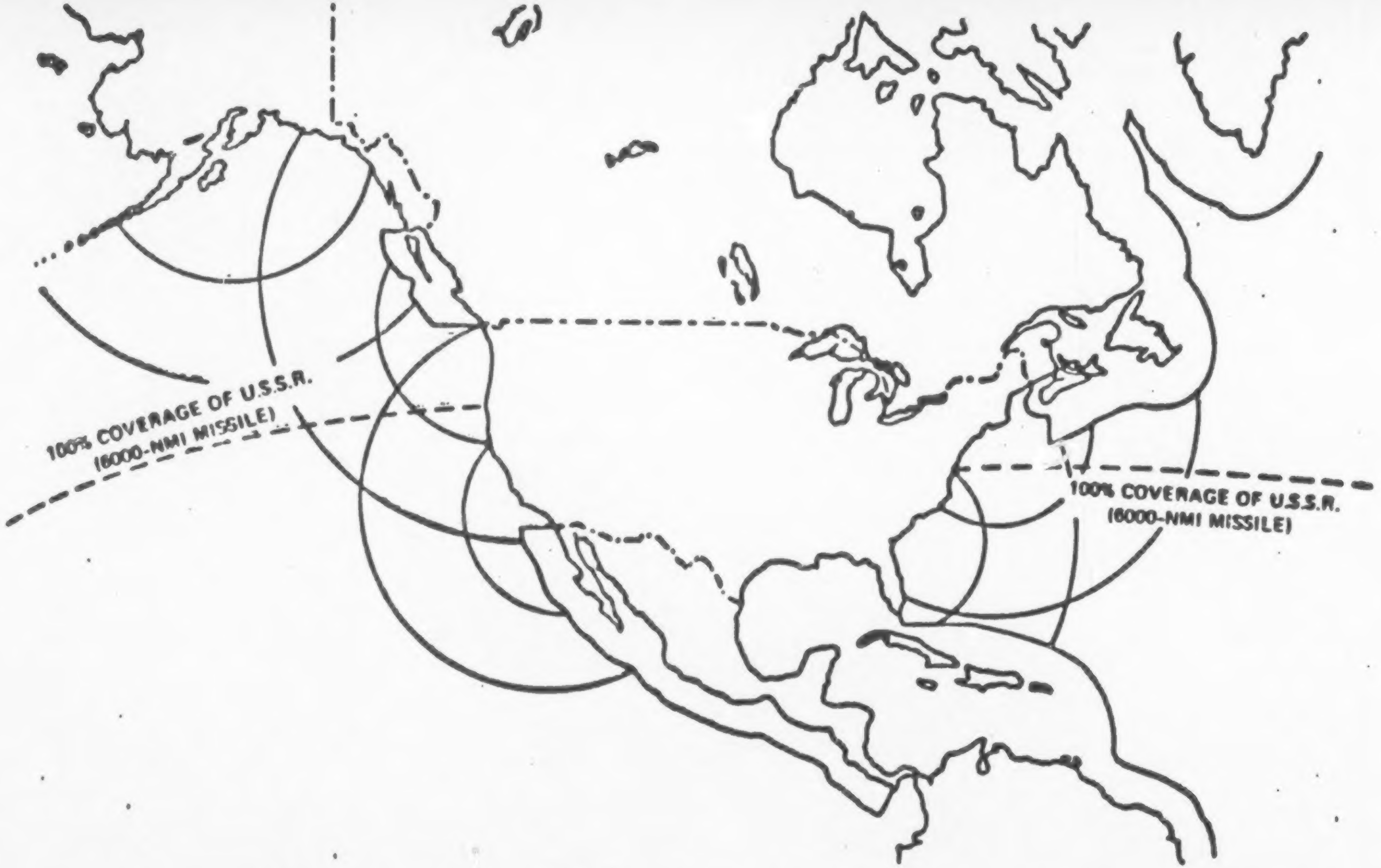

100% COVERAGE OF U.S.S.R.
(6000-NMI MISSILE)
100% COVERAGE OF U.S.S.R.
(6000-NMI MISSILE)

Figure 2: Potential Deployment Area Given 500-NMI (nautical mile) and 1000-NMI Operating Ranges

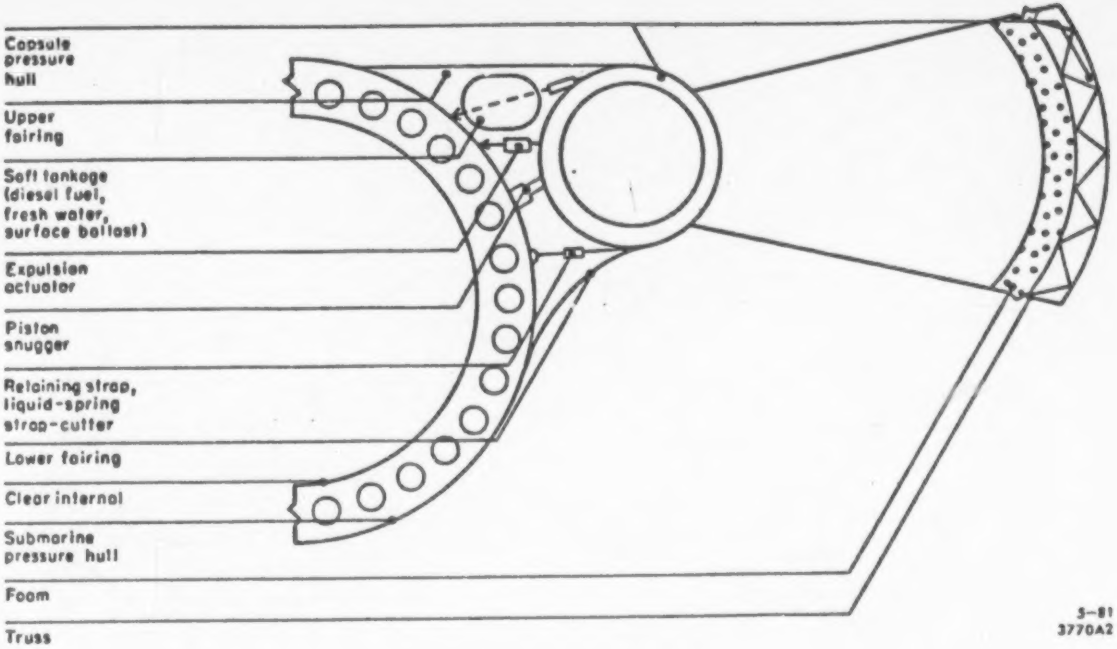

Capsule pressure hull
Upper fairing
Soft tankage (diesel fuel, fresh water, surface ballast)
Expulsion actuator
Piston snugger
Retaining strap, liquid-spring strap-cutter
Lower fairing
Clear internal
Submarine pressure hull
Foam
Truss
5-81
3770A2

Figure 3

This shows a cross-section illustrating how fuel, freshwater, and surface ballast are carried outside the pressure hull in soft tankage. One sees also a detail of the capsule structure, stiffened by an internal truss, and the missile within the capsule, supported gently against impulsive shock load by resilient foam between the missile and the capsule.

ABSTRACT

of

TESTIMONY ON BASING THE MX AT SEA ON SMALL SUBMARINES:
THE SUM SYSTEM

by

SIDNEY D. DRELL

Thank you very much for the opportunity to appear once again before these subcommittees and to present my views on a survivable and effective basing system for the new MX missile. In my testimony before you a year ago I advocated basing the MX at sea on small submarines - i.e., the Smallsub Underwater Mobile (SUM) system. Since then this concept of basing the MX at sea in capsules, mounted horizontally, external to the pressure hull of small submarines that are deployed near the U.S. coastlines has been developed much further by extensive technical analyses.

I. Basic Assumptions

1. It is not an acceptable policy for the United States simply to ignore the growing threat to our fixed land-based ICBM force of 1000 Minutemen and 53 Titan II missiles. The issue before the nation is not whether - but how - to respond to the growing Soviet ICBM threat to the U.S. land-based ICBM force.
2. It is desirable for the United States to maintain a broad diversity of strategic nuclear deterrent forces with different operational characteristics, and potential vulnerabilities and failure modes.

II. The MX Multiple Protective Shelter (MPS) System is Seriously Deficient

A fixed, land-based multiple protective shelter (MPS) deployment of the MX is not a satisfactory response for the U.S. to the growing threat to our land-based ICBM's. The principal deficiencies of an MX/MPS that lead me to this conclusion are the following:

1. *It will be predictably vulnerable by the time it is deployed.* In the absence of current or future SALT limits on the maximum number of threatening Soviet warheads, any multiple aimpoint system such as the MX/MPS has no assurance of catching up with the threat. It may lead to nothing more than an open-ended race between Soviet warheads and U.S. concrete shelters. I am confident that U.S. military technology has more to offer our citizens than paving valleys of Nevada and Utah with concrete in response to the Soviet challenge.

2. *Survivability of the MPS depends on the new and high risk technology and operational requirements for maintaining preservation of location uncertainty (PLU) of the missiles versus the many decoys*. A missile has many observable signatures, and it will be possible to gain confidence in an effective PLU technology only after successful full-scale tests can be carried out on an actual deployment. Since one can never be certain of success in maintaining PLU, and failure would be catastrophic, pressures will inevitably grow to tighten the security requirements, to expand the local security areas around the system and to expand counterintelligence efforts in order to maintain a viable system.

3. *With such a system it is a question of "all or nothing*." Only when the MX/MPS deploys more aimpoints than the number of threatening warheads - i.e., only *after* the first half of the system is deployed, even against an accurately projected threat that is limited by the unratified SALT II treaty - do we even begin to realize an appreciable gain in retaliatory capability, as measured by survivable megatonnage. (Figure 1)

4. *ICBM's that are deceptively based on land will add new difficulties to our ability to verify limitations on force deployments. This contributes neither to our security nor to prospects for future progress in verifiable arms control*. I find it difficult to imagine an advantage for the United States with its open society in competing with the closed Soviet society to maintain secrecy and deception. We should prefer to compete with the Soviets on our own home turf of mobility and agility using reliable technologies.

III. *Advantages of Basing the MX at Sea on Submarines*

Sea-basing the MX on submarines avoids these four deficiencies of the MX/MPS:

1. Mobile submarines moving invisibly under the ocean's surface are currently survivable and are predictably survivable for the foreseeable future.

2. A submarine based deployment does not require developing any risky new technologies or procedures, but builds on existing currently successful practices. At the same time it is possible to introduce very different operational characteristics from the existing Poseidon/Trident force in order to prevent the Soviet Union from concentrating its anti-submarine warfare (ASW) efforts against one system only. These differences include deploying many small submarines with reduced observables and operating in new ocean areas near to U.S. shorelines.

3. Each additional submarine adds incrementally to the survivable megatonnage. To a good approximation its "value" is proportional to the buy which can be readily adjusted in accord with possible future changes in the strategic needs of the U.S.
4. Submarine deployments can be monitored in accord with currently agreed procedures developed at SALT II for counting and verifying launchers.

IV. Description of SUM

SUM would be a deployment of small non-nuclear-powered submarines operating within 500-1000 nautical miles (nmi) of the continental United States and in the Gulf of Alaska. Figure (2) shows the suggested deployment areas. Each submarine will carry two encapsulated MX missiles mounted horizontally, external to its pressure hull. Limited operating range, short mission duration (initially no more than four weeks), and a small crew (of about 20 to 25, consistent with safe, efficient operation aided by automation) make possible the concept of small submarines with hull displacements of no more than about 1,200 tons. The total displacement of a SUM boat carrying two encapsulated missiles is about 1700 tons. This is comparable to World War II submarines and about one-tenth the size of the new Trident missile submarines.

The primary function of the crew would be to maintain sovereignty over the nuclear-armed missiles; guard against piracy, sabotage, and interference; perform safety checks and maintenance; and, of course, operate the submarine. Full power of decision to launch the missiles would reside with the President (or his successor as national command authority), and orders would be transmitted by encrypted communication to the missile.

With their limited range and duration, SUM submarines have very modest power requirements, so nuclear propulsion is neither necessary nor desirable. More than 20,000 megatons - a number that far exceeds the total Soviet arsenal - would be required to barrage a total SUM deployment area of 1 million square nautical miles.

The SUM force can reliably achieve high accuracy comparable with that envisioned for the land-based MX. To correct errors in flight parameters, the missile would receive radio signals during the boost from the Navstar-satellite global positioning system (GPS) or a network of onshore transmitters forming a ground beacon system. Line-of-sight contact with a large and inexpensive network of such beacons could be achieved for submarine launches as far as 500 miles offshore. The duration of missile flight in radio line of sight with ground stations and below ionospheric regions would be sufficiently long that this information would not be distorted by high-altitude nuclear detonations.

The current U.S. submarine missile force has a robust and redundant command, control, and communications system, but it is ordinarily viewed as providing less confidence and security than the bomber and land-based ICBM components of the triad. These reservations do not apply to SUM. Because of its coastal deployment, SUM need not rely only on world-wide communication networks. Existing very-low-frequency (VLF) transmitters can be supplemented by equipment at dispersed survivable ground stations or by airborne transmitters much less powerful than those now carried by the navy TACAMO (take-charge-and-move-out) aircraft. Ultimately, other means of communication are available.

The SUM system would maintain about 55 boats with 110 missiles at sea, corresponding to the design goal of survivable warheads for the proposed land-based MPS deployment of MX.

SUM is a specific sea-basing proposal that constitutes an effective, timely, and economical response to the Soviet threat. It retains the major desirable characteristics of the current ICBM force and therefore preserves a healthy diversity in the U.S. strategic deterrent.

V. Changes in SUM Design

The SUM system described above has evolved in several aspects from the one originally described: proposed operating areas and submarine displacements have been increased, and diesel-electric propulsion is envisaged for Phase I of the SUM deployment. The net effect of these changes is that the system we are proposing is more in keeping with currently developed technologies and has considerably more flexibility for responding to hypothesized, although presently unforeseen and unknown, Soviet anti-submarine warfare (ASW) threats of the future.

VI. Fiction about SUM

1. *SUM is vulnerable to a tidal assault by underwater nuclear explosions.*
2. *One cannot achieve ICBM accuracy with a sea-based MX.*
3. *One will not have as good command and control of the sea-based missiles as can be achieved with the land-based ICBM's.*
4. *Land-based ICBM's have a unique strategic property of instant readiness that cannot be achieved by a sea-based force.*
5. *It will take longer to deploy a SUM system than the MX/MPS and therefore SUM is not a timely response to the threat.*
6. *SUM will be more expensive than the MX/MPS.*
7. *SUM would have no advantage relative to the Trident force.*

Each of these claims is rebutted in the full text of my prepared testimony for the Subcommittee hearings.

VII. The Advantages of SUM Plus Trident

SUM is not a substitute for or a competitor of Trident submarines. The United States is committed to the Trident submarine construction program, which should be strengthened and expedited to ensure its success. I advocate a mixed deployment of SUM plus Trident because their operational and physical differences insure a broad diversity of our sea-based deterrent. In fact, deploying SUM means quite the opposite of reducing our deterrent from a triad to a dyad. If the U.S. maintains a constant total number of deployed launchers in our strategic forces, most of the current Minuteman ICBM force would be retained along with SUM. Our deterrent would, indeed, be built of four different components: bombers with air-launched cruise missiles, gravity bombs, and SRAM's; Minuteman ICBM's; Trident/Poseidon, and SUM.

VIII. Summary and Recommendations

There is no technical obstacle to putting MX to sea in a SUM deployment that is survivable, effective, and meets the essential goals of the MX/MPS program. SUM also is a deployment that poses no new verification difficulties for arms control.

In contrast to the MX/MPS, SUM will add effectively to the U.S. survivable megatonnage whether deployed in part or in full. The survivability of SUM is not sensitive to the Soviet ICBM threat, and its level of deployment can be adjusted in accord with progress and prospects in arms control negotiations.

In recommending the SUM basing of MX, I would like to record my priorities for defense programs designed to address the security needs of the United States in the coming decade. In order, they are:

1. Strengthen our conventional (non-nuclear) forces by improving their readiness and effectiveness with troop training and needed equipment modernization.
2. Improve our command, control, communications, and intelligence (C^3I) capabilities, and thereby the overall effectiveness of the existing deterrent forces.
3. Expedite and strengthen the Trident submarine construction program with effective management and budgetary support. One Trident boat at sea adds as much to the survivable U.S. retaliatory force as would all of the first half of the MPS deployment (2300 shelters and 100 MX missiles). See Figure 1.
4. Modernize the bomber component of our strategic forces by expediting and completing deployment of the air-launched cruise missiles (ALCM's) and by developing a modern bomber. This need not be a penetrating bomber against the stacked Soviet air defenses, but a general purpose bomber capable as a platform for launching ALCM's and SRAM's and capable for a variety of potential missions in other regions with vital U.S. interests.
5. Initiate the SUM program as a valuable technology for diversifying and strengthening our sea-based deterrent. The ultimate mix of SUM and Trident forces, as well as their total level of deployment, can be adjusted during the coming decade to meet the policy goals of the United States as they evolve in

response to the challenge and to possible progress in the arms control dialogue, particularly with the Soviet Union.

The first four of these recommendations address today's recognized needs and problems. The SUM program in Recommendation 5 will show that the U.S. is determined to maintain a strong nuclear deterrent based on survivable and effective nuclear forces for the foreseeable future. We may hope that the immediate future will also bring evidence of determination and success on the part of the major nuclear powers in their efforts to diminish the dangers of nuclear holocaust and to reduce the already greatly excessive levels of nuclear missiles and megatons in their arsenals. It is impossible to overestimate the importance of resuming an arms control dialogue leading to genuine progress toward these vital goals.

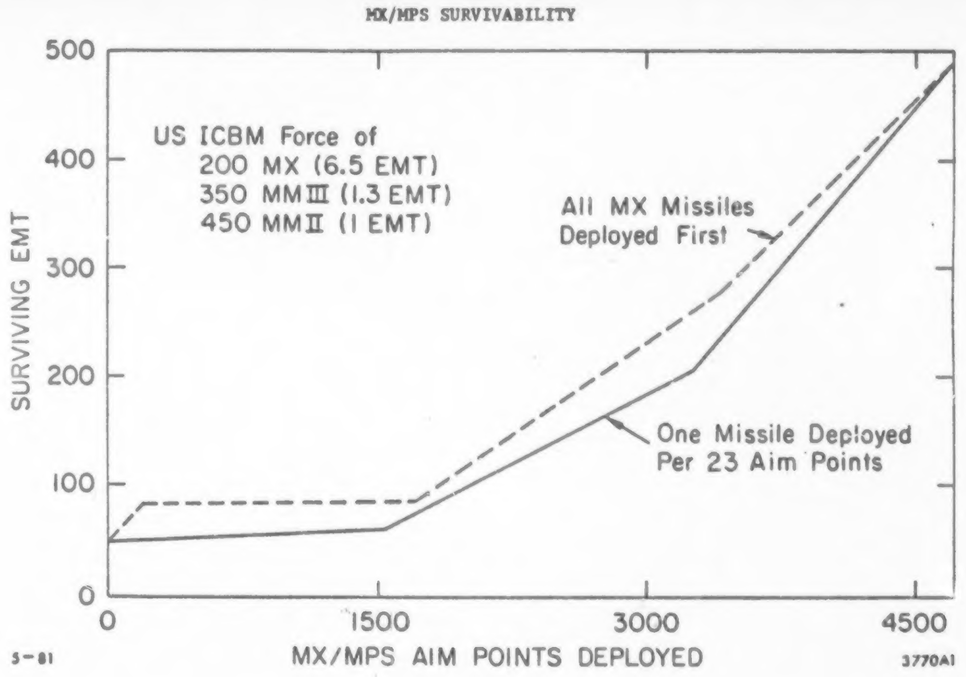


Figure 1

MX-MPS Survivability. It is assumed that 5,000 Soviet RV's, each with a destruction probability of 0.8 against a silo or shelter, are used against the U.S. ICBM force. EMT defines the effective megatonnage. The Minuteman II missiles are assumed to have 1-megaton warheads, the Minuteman III to have 3 MIRV's, each of about 200-kiloton yield, and the MX to have 10 warheads of about 400-kiloton yield. The effectiveness of a warhead against large targets is determined by the ground area subject to destructive overpressure, while that of a highly accurate force against silos is determined only by numbers of warheads. Thus, the EMT of a force is obtained - as a compromise - by summing the megatonnage of each warhead raised to the 0.5 power.

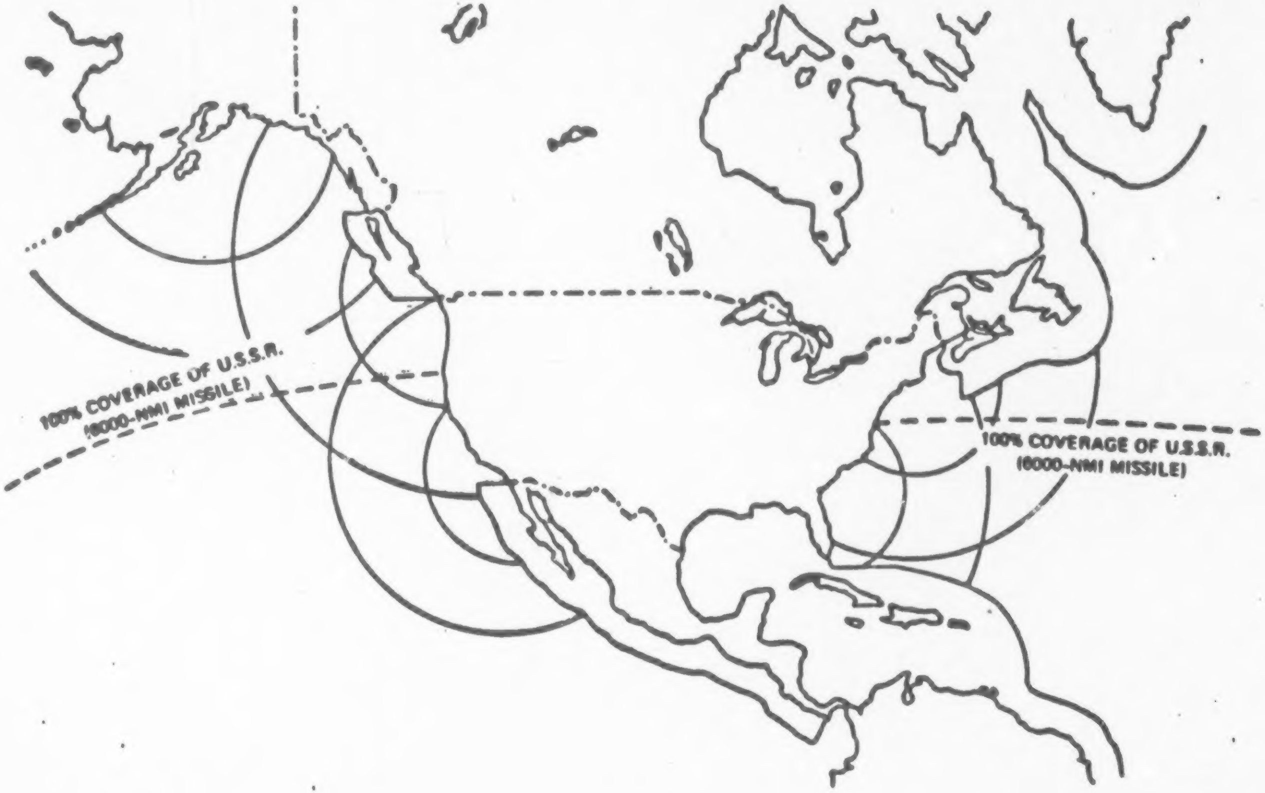

100% COVERAGE OF U.S.S.R.
(6000-NMI MISSILE)
100% COVERAGE OF U.S.S.R.
(6000-NMI MISSILE)

Figure 2: Potential Deployment Area Given 500-NMI (nautical mile) and 1000-NMI Operating Ranges

BIOGRAPHICAL SKETCH

Sidney D. Drell

Present Position

Lewis M. Terman Professor, Deputy Director, and Executive Head Theoretical Physics, Stanford Linear Accelerator Center, Stanford University, Stanford, California

Present Activities

Chairman, High Energy Physics Advisory Panel, U.S. Department of Energy (formerly AEC and ERDA)
Consultant, Senate Select Committee on Intelligence
Consultant, Office of Science and Technology Policy
Consultant, Office of Technology Assessment, U.S. Congress
Consultant, Los Alamos Scientific Laboratory
Member, Board of Directors, The Arms Control Association, Washington, D. C.
Member, JASON Division, SRI International (formerly Institute for Defense Analyses)
Former Member of JASON Steering Committee
Member, Board of Trustees, Institute for Advanced Study, Princeton, New Jersey
Member, Board of Governors, Weizmann Institute of Science, Rehovot, Israel
Member, Advisory Committee, MIT Physics Department
Member, Board of Directors, "Annual Reviews, Inc."
Member, Council on Foreign Relations, New York

Professional and Honorary Societies

American Physical Society (Fellow)
National Academy of Sciences
American Academy of Arts and Sciences

Phi Beta Kappa
Sigma Xi
Phi Kappa Phi

Awards and Honors

Ernest Orlando Lawrence Memorial Award - 1972 - for research in Theoretical Physics (Atomic Energy Commission)
University of Illinois Alumni Award for Distinguished Service in Engineering - 1973
Guggenheim Fellowship - 1961-62 and 1971-72
Richtmyer Memorial Lecturer to the American Association of Physics Teachers, San Francisco, California - 1978
Leo Szilard Award for Physics in the Public Interest - 1980 - presented by the Forum on Physics and Science of the American Physical Society
D.Sc. (Honorary), University of Illinois, Chicago Circle - 1981

Recent Positions and Activities

1978-80	Member, Energy Research Advisory Board, U.S.Department of Energy
1969-76	Member, Editorial Council, "Annals of Physics"
1966-70	President's Science Advisory Committee
1960-73	Office of Science and Technology, Executive Office of the President, Member (or Chairman) of PSAC Panels on national security problems
1974-76	Defense Science Board Task Force
Spring 1975	Schrodinger Visiting Professor, Univ. of Vienna, Austria
Spring 1971	DuPont Lecturer, Univ. of Pennsylvania
Fall 1962, 1970	Visiting Professor and Loeb Lecturer, Harvard Univ.
Winter 1965	AVCO Lecturer, Cornell Univ.
1971-74	Member, Physics Visiting Committee, Harvard Univ.
1967-68	Member, National Accelerator Laboratory Physics Advisory Committee
1966-69	Member, Advisory Council, Physics Dept., Princeton Univ., Chairman 1967-69)
Spring 1979	Visiting Fellow, All Souls College, Oxford Univ.
1969-1981	Consultant, U.S. Arms Control and Disarmament Agency
1973-1981	Consultant, National Security Council

Personal Data

Born September 13, 1926 - Atlantic City, New Jersey
Married (Harriet J. Stainback, Minter City, Mississippi)
Children (Daniel W., b. 1953; Persis S., b. 1955; Joanna H., b. 1965)

Education

1946	A.B., Princeton University
1947	M.A., University of Illinois
1949	Ph.D., University of Illinois

Special Fields

Theoretical Physics: Elementary Particle Physics & Quantum Theory

Publications

Three books and numerous papers in theoretical physics

STANFORD UNIVERSITY LINEAR ACCELERATOR CENTER

STATEMENT OF SIDNEY D. DRELL, DEPUTY DIRECTOR, STANFORD LINEAR ACCELERATOR CENTER, STANFORD UNIVERSITY

BASING THE MX MISSILE ON SUBMARINES: SUM SYSTEM

Mr. **DRELL**. Thank you, Senator, for the opportunity to appear again.

Since I was here a year ago I led another summer study done at the direction of the Under Secretary of Defense for Research and Engineering in which we carried the technical analysis of the SUM system much further. My testimony today has that summer study as its technical basis. I will explain how the conflict has evolved.

The assumptions you know from my testimony last year; namely, I believe, we have to respond to the growing threat to the Minuteman force and maintain diversity of forces. My criticism of the MX-MPS is the same as last year. I will explain it if you would like.

Senator **LAXALT**. Summarize it.

Mr. **DRELL**. Namely, I consider it a system that is predictably vulnerable when deployed, particularly in the absence of SALT limits. Its survivability is dependent on Soviet actions, not our own. It involves a technology of preservation of location uncertainty, which is a new technology, high risk technology, that if it fails the system itself will fail catastrophically and about which we will have confidence only if the system is deployed.

Technology. It has the aspect of maintaining secrecy and compartmentalization of information in a cadre of our society, Utah and Nevada, and pressures that will generate with tightened security requirements and counterintelligence. Essentially, it puts our security with high dependence on that type of issue of maintaining effective secrecy and deception in the midst of our society.

It is a system which gives you survivable megatonnage only when it is completely deployed. This is in my testimony from last year but surviving megaton even against a SALT-limited Soviet threat is not achieved until you are down to the last one-third of the deployment. It is not a system you can deploy part of. You deploy all of it or you have nothing.

Finally competing with the Soviets on deceptive basing will be harmful for future prospects of verifiable arms control. For those reasons I found that that system is one which would not meet U.S. security needs.

Going to sea avoids those four problems. Mobile submarines moving invisibly under the ocean surface are survivable and there is no known technology that will rob us of that survivability.

SOVIET SUBMARINE DETECTION TECHNOLOGY

Senator **LAXALT**. We have gone into that extensively on a classified basis and to the extent you can speak to it on an unclassified basis what is the prospect for Soviet technology developing on detection?

Mr. **DRELL**. My assessment of their work is that for the foreseeable future as a technical man I would never project the technical horizon beyond the decade. I can't see anything that will compromise either our Trident force or submarine arsenal.

Senator **Laxalt**. Their technology has historically been incremental. There have been very few breakthroughs. Is there anything in this technology that would change the historical pattern?

OCEANIC ACOUSTICS

Mr. **Drell**. None whatsoever. As far as acoustics is concerned, the ocean is very hard to see through. It bends sound waves because of the thermocline. What you can do with very good computer and data handling and very large arrays, active acoustics in the low frequency, 100 Hertz region, you can ideally see for many miles through convergence on propagation. I have a picture. This is a profile of the velocity as a function of depth in water. There is a deep sound channel at 4,000 feet. It acts like a lens does for light. Here the sound velocity is high.

It decreases and gets high again. In shallow water, less than 8,000 to 10,000 feet deep, then the sound energy which bends back and forth runs into the bottom and gets absorbed. A large part of the area that we are talking about for our coastal submarines is acoustically shallow. Rather than the energy propagating this way, the bottom of the water, less than 8,000 or 10,000 feet, the bottom of the ocean is there and energy is being absorbed.

Even when you have long-range propagation sound waves bouncing back and forth, if you are in the middle between the convergence zones you are not seen.

Senator **Laxalt**. How far offshore are we talking about?

Mr. **Drell**. Five hundred miles offshore, 500 to 1,000 miles offshore.

INCREASE IN SUBMARINE SIZE

The submarines we talk about this year are 1,700-ton submarines. Twelve hundred hull and 500 tons is the weight of the two capsules.

Senator **Laxalt**. Have those specifications changed since we discussed it last year?

Mr. **Drell**. Last year I discussed a 1,000-ton submarine, now 1,700.

Senator **Laxalt**. Why?

Mr. **Drell**. When we went to the technical study we found very little increase in operational complexity and cost, we could get much more growth potential and conservative style of operation.

Senator **Laxalt**. Translate that for me.

Mr. **Drell**. We put more crew on submarines, 21 to 24 members rather than 15, demanding less of automation. We allow for longer missions and longer ranges, 500 to 1,000 miles away from the base instead of limiting ourselves to 200 to 500, because there was no real gain. There was more flexibility. If a Soviet threat were to develop in spite of unknown technology that we are relying on, we double the ocean operating areas something like 2 million square miles. We found that did not add substantially to the cost of the system.

Senator **Laxalt**. How much did it add to the system?

Mr. Drell. We are talking this year of cost in 1982 dollars——

Senator Laxalt. We have been working with 1980 dollars.

Mr. Drell. The costs of anyone speaking for this are not better than 10 percent accurate. The costs that we made last year were made last summer. They were done by comparing the way the Air Force was costing the MX. So, we tried to get an accurate relative cost even though the absolute one is even more suspect. We are talking about a $30 billion system in comparison with the Air Force's $40 billion for investment and 10 years of operation.

SUBMARINE MISSILE COSTS

Senator Laxalt. Now the 30 includes the missile?

Mr. Drell. The 30 includes the missile, that is right. It includes 250 MX missiles.

Senator Laxalt. How much are you allocating of that 30 toward the cost of the missile? Just roughly?

Mr. Drell. Roughly, $5 billion for purchase and about $5 billion for R.D.T. & E. of the system of which some is the missile itself.

Senator Laxalt. So, you are talking essentially the pure cost of deployment subwise around 20.

Mr. Drell. That is right, 22 roughly and $8 billion for 10 years of O. & S., operation and support. That is an approximation.

Senator Laxalt. That compares with what with MPS?

Mr. Drell. The MPS is 40.

Senator Laxalt. They told us 33 in 1980 dollars.

Mr. Drell. Thirty-three was acquisition and another 7 for 10 years of O. & S. I believe that is the figure that is being carried now.

Senator Laxalt. I thought we topped off at 33 with the Air Force? OTA as $39 billion.

Mr. Drell. The Navy study, also in comparison, was the SPC-554 study done by the Navy last summer also came in with a 40 total. The investment cost in missiles and capsules is a little under $5 billion. The R.D.T. & E. cost of the missile is somewhat more than $5 billion.

Senator Garn. On what basis are you making your estimate?

Mr. Drell. I want it correct. This is fiscal year 1980 dollars.

COST ESTIMATES ON SUM SYSTEM

Senator Garn. With the data available on SUM, still in a concept status, I cannot possibly believe you can be within 10-percent accuracy. All of them are going to be off.

Mr. Drell. I consider that is the weakest part of our study. I would not like to say we are offering a study that is cheap.

Senator Garn. That was the testimony last year by the SUM people that they would not place cost estimates on it because they agreed it was almost impossible to do so because you were not anywhere into engineering design, just a concept and pulling figures out of the air.

Mr. Drell. That is a fair criticism. The Navy did a study, SPC-554 study, in an encapsulated missile submarine. They said this was survivable basing, effective to achieve accuracy, and they costed theirs out at $40 billion.

Senator **Garn**. First of all, there is no need to criticize MPS. Neither Senator Laxalt nor I agree it is a good system. We have not for a long time. There is no doubt in testimony this week and previous testimony that the base line of $4,600 is not sufficient before it is even finished. It could be overwhelmed at that point, so it would have to grow bigger. Also as given from OTA and others that there are really no good systems, that all of them have major drawbacks, every single one of them.

We are going to end up probably picking the lesser of the evils. I am really concerned about this. I don't have your technical expertise but I don't consider SUM one of the five or six that is even worth considering. We are taking a great deal of time on it. I don't have your technical capability. You can show me all those charts but I was a Navy antisubmarine warfare pilot. From a practical standpoint I have looked for submarines. I don't know who else in this room have but I have, so I do know something about it from a practical application. I don't know how black boxes work, how people designed them, but I know how to use them.

You are playing there with figures. Now what I am talking about with World War II depth bombs we had to be within 17 or 18 feet of a sub in order to expect damage to the hull sufficient to cause leaks and probably sinking. We go with the initial atomic depth bombs which have a kill radius, depending on water conditions and depth and so on, of about 1 mile. They don't need to find them that closely. It seems to me this system, even if it worked a you say or you think it will, that we are placing this country at greater risk than we are with this Rube Goldberg MPS system in being overcome because you can get, and here I don't want to get into classified stuff, but you can be many, many miles away, you don't have to have much sophisitication or really care where those submarines are. You can start dropping those big megatonnage weapons and kill all sorts of subs, some you did not even know were there.

So, I am simply not willing to consider this. We have already got 52 percent of our atomic warheads at sea already, forgetting the less accuracy and all the problems that can be solved. You are telling us that you want us to take a risk that the Soviet Union does not have a breakthrough in ASW or they can't go barraging. I can't buy the former as an antisubmarine warfare pilot that this is a viable option at all.

Mr. **Drell**. I would like to respond to that.

BARRAGING AND BREAKTHROUGH

One part of the question is barraging, the other is the breakthrough. As far as the barrage is concerned, you can refer to any of the published studies that have been made now, but a submarine with the design technology that submarines now have, of the order of 4 or 5 nautical miles distance from a 1 megaton weapon, has a peak translation or velocity imposed on the surface of a figure such that it is considered survivable. That is the number used in the Navy's own study, the number used in our study.

If you take a number like a vulnerability radius of 4 nautical miles, that means an area within which a submarine will be destroyed by 1 megaton is about 50 square nautical miles. I am talking about a deployment area. Last year we were talking about a deployment area of one-half to 1 million square nautical miles. This year, because we made the submarines larger, we are talking about a 2 million square nautical mile deployment area. Two million square miles to be barraged when you consider a 50-square-mile vulnerability area per megaton is something like a 40,000-megaton barrage. That is more than the entire Soviet megatonnage. I don't think that barraging is a credible threat to this submarine system.

KILL RATING OF SUBMARINE FORCE

Senator **Garn**. There are estimates that go much higher than that as far as that kill rating but you are not going to have to barrage 2 million square miles. My point is that they don't have to determine where they are as close as they do right now. Therefore they are not going to barrage 2 million square miles. I agree with you completely, but if they know it is in an area——

Mr. **Drell**. That is right. We did an extensive study, it is a classified study, of the problem but I think it perhaps would have more crdibility if you would have the Navy's own study, the one done by System Planning Corp. study 554 on trailing, on locating, either by radar for submarines snorkeling when the mast can be seen, and we looked at the possibilities of acoustics. There are extensive analyses which show that the possibility of locating at any time a sizable fraction, a finite fraction of a submarine force like this is negligible.

Senator **Garn**. You and I can argue back and forth. I do not agree this is a viable system and recommending it to the President, putting all our eggs in one basket. Essentially you are recommending that we abandon the Triad. So we disagree on that. Nevertheless you may address the second part of my question or statement on the breakthrough.

STATUS OF MINUTEMAN SYSTEM

Senator **Laxalt**. Before you get into that, on the point that has been made, and I have heard this is an objection to your proposed system, that we would end up eventually to be with the Diad. Does going your system mean we abandon Minuteman?

Mr. **Drell**. No. I view this as adding to the capability of the U.S. deterrent and for the following reason. Let me assume for the moment that this is a highly survivable system. Once one has satisfied the stated need for survivable megatonnage by seeing the megatonnage now in the Minuteman force exists survivable at sea, the Minuteman stays there, we have a Quadrad. The Minuteman would certainly stay. Had the SALT II treaty been ratified, we would have retained 800 of the 1,000 Minuteman because they would be a force of 200 MX missiles or 100 roughly more likely.

So the Minuteman force would stay and it would be its own added component to the deterrent.

Senator **Garn**. You maintain the 100. The SALT limit on land-based ICBM's was 820.

Mr. **Drell**. MIRV'd. We have 550 Minuteman III's, 450 Minuteman II's. The MPS system deployed 200 MX's against the SALT limited threat. If the notion that this is a survivable system and I would like to get back to that, is valid, we would have to deploy 140 or 150 with a 60- to 70-percent at-sea factor. So, there would still be 850 to 860 in the same total that we now have of ICBM's remaining on land.

I certainly would not get rid of them. I would see to it that we have a system at sea that is survivable, that is the first requirement.

VULNERABILITY OF MINUTEMAN SYSTEM

Senator **Laxalt**. Most of the testimony indictes that Minuteman is vulnerable now or will be very quickly. What would you do in addition to making it not vulnerable?

Mr. **Drell**. The Soviet Union will never be sure that those Minuteman will be sitting in their silos if they attack. They should not be sure they are sitting in silos. On the other hand. I think the President of the United States must not be in a position of requiring them to be used within that 30 minutes. In other words, I don't want this country to be in a position of feeling it must rely on those. I value survivability of force and I think SUM is a survivable system. So I think the survivable megatonnage should be attended to but the Soviet Union should never be sure.

Senator **Laxalt**. If we were to launch under attack for all purposes it would make Minuteman survivable, would it not, because we would not have to worry about its being overwhelmed. They would be out of the hole?

Mr. **Drell**. That is right. Irrespective of whether all the systems are working right within the 15 minutes that we have survivable megatonnage, I don't want the President to feel that he has to launch under attack. But I don't think the Soviet Union should be given assurance they are sitting there either. This is a safety measure to put adequate survivable tonnage at sea.

LAND-BASED MISSILE SYSTEMS IN EUROPE

Senator **Laxalt**. How can we ask our European allies to go land based, as we are doing, when in our own situation we go to sea?

Mr. **Drell**. The commitment of the United States to a strong and effective deterrent force is the major message we want to convey to our allies as well as to our possible enemies. I think that is the message of primary importance. To my mind the question is, and please understand me, I don't think that the MX-SUM system is an ideal or great system either; I grappled with the problem. The country has decided to build an MX missile. I would prefer that the country build other missiles. If I took that as a given, I then ask myself what is the most survivable way I, as a technical person, can come up with to base that system and at the same time develop it to be responsive and accurate? That was stated in the national requirement.

Knowing the drawback to the MX-MPS, I looked around for other candidates. We came up with small submarines and only two missiles per submarine just to be as different as possible from the

Trident force. We wanted to minimize all observables relative to the large Trident submarines. We wanted different ocean operating areas, shallow waters which are harder for acoustic means.

NONACOUSTICAL WORK

Senator GARN. Isn't the Soviet Union doing a great deal of nonacoustical work R. & D.?

Mr. DRELL. So are we. That is why I put it at 10 years when I asked is this system survivable.

Senator GARN. You are saying it is survivable 10 years from now?

Mr. DRELL. Yes; absolutely.

Senator GARN. You are not going to have it in the water until 1989 or 1990. You are telling me it is survivable for a year or two?

Mr. DRELL. Any defense system that we deploy, and I don't care whether it is land, sea, or air, must be built with the growth potential to survive by some active or passive means against a future threat that no technical man, I think, can responsibly design for when looking beyond a horizon of 10 years ahead.

USE OF ABM TO PROTECT MX MISSILE SYSTEM

Senator GARN. How can that effectively be done with ABM?

Mr. DRELL. The trouble with ABM is that I don't know how to make an effective ABM right now, particularly by asking to defend MX missiles or defend 10 warheads with ABM.

Senator GARN. On that one, we spent most of yesterday with people who work on that. You say it is in concept. They submitted a great deal of detail and parts of that system are in fact workable now today.

LOW-ALTITUDE DEFENSE SYSTEM

Mr. DRELL. I understand the load system or low-altitude defense system, with a certain amount of hedging, has been worked on. I think that can be effective. When you are talking about a MX in the silo you are talking about a system that has to defend 10 warheads.

BMD SYSTEM

Senator GARN. Have you personally done any work on BMD?

Mr. DRELL. Yes; for many years. After this testimony next week I will be spending the next 5 weeks looking specifically at the exoatmospheric because I feel that is the major area to understand better the whole infrared question.

Senator GARN. You are right on that; it is. But there are people who feel very strongly that that can be available by 1990 as well. All of these are guess factors but you are telling me 10 years survivability and all the testimony so far has been that you can't put the subs at sea until 1990.

Mr. DRELL. I don't know how to provide assurance on a technical basis.

Senator GARN. No one can.

SUM SYSTEM

Mr. **Drell**. When we design the SUM system and we come back with a larger boat, larger ocean operating areas, we are providing the room, the displacement for defensive weaponry on the boat now. We are providing a larger ocean operating area. I have looked at it in considerable detail, sir, and I don't know the physics. I cannot foresee the physics that will make oceans transparent, yet I recognize that we have to be prepared no matter to which system we go, Senator, that the environment in which it is going to operate between 1990 and the end of the century will have technical challenges there that are not conceived by anyone at this time. That is why it is sensible to have a diversity of forces. We have asked about the submarine force. How do we have different communication links, how do we have different means of achieving accuracy? We will defend many aim points instead of a few. And how do we open new waters to operate in? But nothing answers with assurance the question of beyond 10 years and I think it is a problem that one is indeed going to see with more of one's assets. But one is doing it with different areas of the sea and different operational concepts.

Senator **Garn**. Are you familiar with the OTA study?

Mr. **Drell**. I am on the advisory board of that study. I am quite familiar with it because I have consulted.

OTA DIFFERENCES ON SYSTEM

Senator **Garn**. OTA points out the pluses and minuses specifically. If we go to sea they recommend a larger submarine different from Trident with four missiles. Also they say the major drawback is shipyard capacity, skilled people. Could you address OTA's differences from yours?

Senator **Laxalt**. They were positive about your system with the modifications the Senator mentioned. They indicated our capacity simply to build is very limited at the present time.

Senator **Garn**. They say one of the major drawbacks is time. They think any of these systems would take longer than the land-based system.

Mr. **Drell**. I believe for the IOC, but the land-based system provides for survivable megatonage when it is completely deployed.

Senator **Garn**. They made that same statement as evidence for a submarine. They were talking about 1990 or beyond.

Mr. **Drell**. All of these systems you can count on for the late 1980's to 1990. Technically, there is no reason that we could not build these submarines in 7 years and have them at sea. Admiral Moorer has made that statement.

Senator **Garn**. You are technically correct. Shipyard capacity and skilled people, welders particularly.

Mr. **Drell**. There are obviously many problems getting things done well and rapidly. The nontechnical factors I am not on top of to comment and I recognize that is a problem.

SHIPYARD CAPABILITY IN BUILDING SUBMARINES

Senator **Garn**. We have two shipyards building submarines right now.

Mr. **Drell**. These are different shipyards or have the capability at this point. We have not built an electric-diesel submarine in this country for 21 years.

Senator **Garn**. That only compounds the problem. The very fact we have not, we don't have the people who have built them. It is like anything, once you shut down the assembly line.

Mr. **Drell**. These are much easier submarines to build than the large Trident. The difficulty of building a World War II submarine and a very large submarine handling a major nuclear reactor are qualitative problems.

Senator **Garn**. I agree with you, a bigger submarine is harder to build. You have shipyards that have not built diesels for 21 years. My point is, once you get geared up, yes, you are correct, they are easier to build but gearing up and getting the shipyards the technical capability and to start doing it over again is something else. A Model T is easier to build, too. We would have to put quite a different assembly line together and find people to do it.

Mr. **Drell**. The Navy's own analysis, Senator, in the SPC-554 study which was published, classified study, in May 1980, which was the basis of the work I did last summer, said the first submarine could be available in 7 years of construction time.

NAVY SUPPORT OF SUBMARINE PROGRAM

Senator **Laxalt**. Why is not the Navy here on all fours supporting this system?

Mr. **Drell**. I wish I understood that better. For all the drawbacks we are trying to find the least unattractive option. We have made the problem narrower than need be by saying we are building it around the MX. I find that submariners in the Navy, that retired senior people in the Navy, like Tom Moorer, former chairman of the Joint Chiefs——

Senator **Laxalt**. Is Moorer a fan of submarines?

Mr. **Drell**. He is supportive of going to sea. He believes it would be quicker and cheaper to start with surface ships although subs are the more survivable form. There is an issue about the time scale or cost of surface ships but he certainly has been very strong about going to sea.

Senator **Garn**. He has not supported SUM. He has supported sea-based options.

Senator **Laxalt**. Surface.

Senator **Garn**. Tom supports going to sea in general; however he can get there.

Mr. **Drell**. That is a correct statement. I believe I am reflecting his view correctly when I say he has emphasized surface as a quicker way to fill the gap, which I have not analyzed and I am not able to comment on.

Senator **Laxalt**. If I can summarize where you are coming from, I gather the cost as opposed to the other undesirable options is comparable and we are all guessing.

Mr. **Drell**. I think we should say it is comparable and let it go.

SURVIVABILITY OF SUBMARINE-BASED SYSTEM

Senator **Laxalt**. What you are offering us by way of system is greater diversity in deployment?

Mr. **Drell**. Yes.

Senator **Laxalt**. I guess the bottom line for you is that you are suggesting for us that when this system would be deployed in the late 1980's that it would be more survivable than MPS.

Mr. **Drell**. Absolutely.

Senator **Laxalt**. Isn't that right?

Mr. **Drell**. Absolutely.

Senator **Laxalt**. Isn't that the essence of your theory?

Mr. **Drell**. The essence of my proposal is that it will be more survivable. There are a number of claims about the system, you can't get accuracy, you can't have responsiveness, you can't have command and control. These questions are answered in my testimony. I believe there is no technical argument against the submarine-based system having accuracy, responsiveness, quick command, and control. There is a fundamental political issue.

Senator **Garn**. Excuse me. The questions you can't answer are time and cost. To say that there are no technical arguments, I don't disagree with that. Eventually, we will get the communication system, get the satellites and the accuracy. But when you are talking about that Soviet threat that exists now in 1981, the question is when do those things occur. That is the same thing on the exo-atmospheric. That is the drawback of going to that layered defense, when, that is the question that no one on any of these systems can answer.

Mr. **Drell**. I think the OTA study, if I understand correctly, the Navy study, because of the long leadtime to build a base on which to station submarines, quotes an IOC of 1992. We expect, because the subs are simpler and we need smaller bases, a 1988 IOC and I believe the OTA study comes out 1989 or 1990.

Senator **Garn**. Shipyards with that capability and operating base. I am talking about the increased accuracy and I am talking about communications.

Mr. **Drell**. I am too. I think the technical problem for accuracy is not a time-consuming one. I think construction is the time element here. The technical problem for accuracy is really quite a straightforward technical problem for making command and control more robust, quite straightforward.

Senator **Garn**. I am also talking about construction and money to do that. Those are unknown.

Mr. **Drell**. Again the Navy study, OTA study, our analysis I believe should be considered less expert than that because that is not my forte as a technical man and I confess it.

ACCURACY COMPROMISED IN SMALL SUB USE

Senator **Laxalt**. I hear on the floor a lot one of the objections to your system is that we would sacrifice a lot in accuracy if we went to small subs as opposed to land based. Is there any empirical evidence to demonstrate that theory is wrong?

Mr. **Drell**. Yes; I think the analysis we can make of test firings and the situation with the Trident I missile.

Senator LAXALT. Do you think the Trident firings and testing would be of value in determining whether or not it works for your system?

Mr. DRELL. There are two ways to go for accuracy, if you will allow me to delineate them and say what is known and what is not. It is a good question. We have proposed to use the near coastal basing, 500 miles or so offshore, to use radio input to correct for the fact that a submarine does not know exactly where it is, it does not know exactly that its velocity is zero. These are both parameters when the missile launches and it does not know it orientation accurately enough.

Now that information can be provided by the Navstar system which might not be there after a war starts. So we also talk about the backup of the ground beacon system. I think the possibility is that and straightforward.

The other way of going, which is more conservative, the other way of going, OTA way, is to use a good velocity measuring sonar on a submarine which we certainly have experience with. It is to use acoustic transponder fields for position, one certainly knows how to do that, and star tracker which we have had experience with for orientation. I think one can choose those two technologies or have them both. But this is no technical problem.

Senator LAXALT. You don't think there is any risk involved?

Mr. DRELL. I don't believe there is any risk in accuracy or good command and control. Never say that. I believe that the accuracy problem can be achieved with little risk. I believe the command and control problem is comparable to any system, land based or sea based, when you talk about your command and control operating after you have been attacked first and you lose your land lines. I think the risk which Senator Garn has correctly focused on is one of survivability to what may happen 20 years down the pike on ASW.

POST-ATTACK EFFICIENCY OF COMMAND AND CONTROL

Senator GARN. I am not sure it will be that long because almost every estimate that we have had, national intelligence estimate estimate, Joint Chiefs of Staff, has been wrong. Like in 1977 they predicted by 1985 or so Minuteman would be vulnerable due to the increased accuracy. The Soviets had the increased accuracy 5 years sooner than we predicted just 4 years ago.

Let me carry this command and control further. As a given let us assume everything you say in SUM works properly or in any submarine. You have Trident II or whatever. And you are correct in all your assumptions and you can communicate. You tell me about the problem of fratricide, and here I will be very careful, but you know there is a very fine time line of just a few seconds from where that first warhead goes off because you have the blast effect and the blast effects are over before you get the damage from the second incoming missile.

You have only a few seconds. You are talking about a moving platform that does not know exactly where it is and we want to strike back at the Soviet hard targets. Do you really think it is conceivable you can coordinate that kind of attack with two missiles per submarine and these submarines spread out all differently and coordinate multiple attacks on the Soviet silos in a period of a relatively few seconds, less than 20 seconds, and have all that coordinated? I can't conceive, with the Trouble I have had getting communications just as a pilot sometimes, that that is a technical problem that we can be told here today you can handle that fratricide problem with a sea-based system.

Mr. **Drell**. Let me put your same questions to the other systems. Remember the MX-MPS, which is all I know to compare it against——

Senator **Garn**. We are all against that. I don't know why we keep comparing them.

Mr. **Drell**. Fine, the question is what system does not have these problems? I think that for anyone to go up to the President and say, based upon a system that has never been tested over the North Pole or over operational trajectories and under operational conditions, that he can really deliver with high confidence a RV on a hard silo, it is quite an extrapolation from all our experience. I don't think any one system is free of that unknown.

Senator **Garn**. I think that is less of an unknown than the problem I talked about because we certainly have a lot of tests of our system and so have the Soviets on the Kamchatka Peninsula.

Mr. **Drell**. Always East-West, never North-South

Senator **Garn**. What about MX in existing Minuteman silos with three or four semi-silos and minimal MPS in the existing fields with a site defense and layered exo-atmospheric defense?

Mr. **Drell**. That is not a durable force, which is what one is talking about.

DURABILITY OF SEA-BASED SYSTEM

Senator **Garn**. How long is sea-based durable?

Mr. **Drell**. A month.

Senator **Garn**. A month?

Mr. **Drell**. Yes; because the submarines can be out there for months.

Senator **Garn**. You are not going to have a diesel-electric submarine out there for months? As soon as they run out of water, food, and diesel fuel, after their base is attacked on a first strike where are they going to go?

Mr. **Drell**. When I say months I don't mean 10 months. I mean 2 or 3 months.

Senator **Garn**. In other words they are going to sit out 3 months?

Mr. **Drell**. Sitting quitely.

Senator **Garn**. You would agree their bases would be attacked?

Mr. **Drell**. Yes.

Senator **Garn**. Right off the bat, so they have no place to go home to.

Mr. **Drell**. That is true.

Senator **Garn**. They are durable or they have endurance as long as they have food, fuel, and water.

Mr. **Drell**. That is right, several months.

Senator **Garn**. I think that is the strongest point of your system. Everything I have understood here this week would indicate that whatever percentage of survivability we come up with after a first strike, whatever we do, all we are really buying is an hour or so. Because if they come again, I think that they effectively will take whatever is left. The strength of your system, it seems to me, is that it is more survivable than that unless they can develop some kind of barrage that would wipe you out on that first or second strike.

Mr. DRELL. That is the word that has driven us in this direction.

SUBMARINE ENDURANCE

Senator GARN. What we are talking about right now is beyond the initial survivability. We are talking about endurance. If you are talking about a nuclear submarine, then you have endurance for a long period of time. With the diesel-electric you are going to be out there 2 or 3 months without new provisions or without attention to maintenance problems.

Mr. DRELL. OTA's projected standard mission is a 2-month mission. Our standard mission is a 1-month mission. It is a matter of design points. That is one of the reasons the OTA study came up with a larger submarine. They operated more in keeping with today's Navy with a larger crew on it and having longer endurance. I was driven to maximizing a number of boats out there just to be as different as possible from Trident. I am not sure that their design is better or ours is better. We are talking about a concept that preserves much diversity but survivability to my mind is the important factor.

CREW MEMBERS FOR INITIAL STUDY

Senator GARN. How many crew members do you have in your initial study?

Mr. DRELL. We talked about a range of 21 to 24.

Senator GARN. Even with that range you have crew members that are going to have to perform at least two or three technical functions, do their own laundry, cook their own food, handle the paper work, fill out the forms, all of that.

Mr. DRELL. The paper work and forms are exactly what they won't do. That is exactly what is the easiest thing to be automated. Something like 36 percent of the time of the crew in one of our nuclear submarines is spent doing nothing but watching or doing things that machines could do.

MOTIVATION OF SUBMARINE CREWMEN

Senator GARN. That may be true. With the problem of retention in the Navy how many volunteers will you get? An All-Volunteer Force will not sit 2 or 3 months in a diesel-electric boat. The problem is there with the nuclear submarine with the crew receiving one-third of what the controllers make who are going to strike on Monday.

Mr. DRELL. You certainly mentioned a problem which I don't know the answer to, clearly the problem of motivating the right kind of people in the Service, holding them.

Senator **Garn**. That is why I went into Navy Air. I did not want to be on the surface months at a time, let alone underwater.

Mr. **Drell**. We talked about the standard mission being 30 days for that reason. We have costed our system for a 30-day mission.

DEPLOYMENT OF SUM AND TRIDENT SYSTEMS

Senator **Laxalt**. Mr. Drell, what I would like to have you do, if you would, if the Senator does not have any questions, is kindly sum up for us. No pun intended.

Mr. **Drell**. First of all I don't believe SUM should be viewed as a competitor for the Trident submarine. The United States is committed to the Trident sub program and that it should be strengthened and expedited to assure success. I advocate the deployment of SUM and Trident because they have been designed for different operations and they provide a rather broad diversity to our sea-based deterrent force. As I say, SUM is not going to a Diad from a Triad because we would retain the ICBM force on land and therefore we would have a Quadrad, the bombers with their ALCM's, SRAMS and gravity bombs and Minutemen, Trident, Poseidon, and SUM.

There is no technical obstacle to putting the MX to sea and some deployment that is survivable, effective and meets the essential goals that were designed and defined in the MX-MPS program. Deployment poses no new verification difficulties for future arms control. SUM is contrast to the MX-MPS will add effectively to U.S. survivable megatonage, whether deployed in part or in full.

VERIFICATION OF SUBMARINE CONSTRUCTION

Senator **Laxalt**. For the purpose of the record and for my own edification, track through the verification problem, why there would be no verification problem?

Mr. **Drell**. We now verify submarine construction by national technical means in the shipyards. The count in SALT I or II comes when the submarine goes to sea and completed its sea trials. The procedures for tracking the construction have been followed for 10 years and that would not change in any way.

Senator **Laxalt**. There is no problem with the number of missiles?

SECURITY NEEDS OF UNITED STATES DURING COMING DECADE

Mr. **Drell**. No; because it is a very obvious construction. There is no verification problem. Survivability of SUM is not sensitive to the Soviet ICBM threat and level of deployment can be adjusted in accord with progress and prospects in arms control. My priorities in recommending SUM as a basing system for the MX, I wish to report here my priorities for defense programs designed to address the security needs of the United States during this coming decade are: First, strengthen our conventional forces (nonnuclear) by improving their readiness and effectiveness with troop training and needed equipment modernization; second, improve our command, control, communications, and intelligence capabilities and thereby the overall effectiveness of our existing deterrent forces and on this whole issue of launch on warning it makes that a much more credible possibility although I never want to recommend that the country rely on it. I want it to be available; third, expedite and strengthen the Trident sub construction program with effective management and budgetary support. One Trident boat at sea adds as much to the survivable U.S. retailiatory force as would all of the first half of the MPS deployment; fourth, modernize the bomber component of our strategic forces by expediting and completing deployment of ALCM's and the cruise missile program and developing a modern bomber. This may not be a penetrating bomber but a general purpose bomber capable of serving as a platform to launch ALCM's and SRAM's and capable for a variety of potential missions in other regions with vital U.S. interests; fifth, initiate the SUM program as a valuable technology for diversifying and strengthening our sea-based deterrent. The ultimate mix of SUM and Trident forces as well as their total level of deployment, can be adjusted during the coming decade to meet the policy goals of the United States as they evolve in response to the challenge and to possible progress in the arms control dialog.

The first four of these recommendations, bomber, Trident, command and control, and conventional forces, address today's recognized needs and problems. The SUM program, which is recommendation 5, will show that the United States is determined to maintain a strong nuclear deterrent bases on survivable and effective nuclear forces for the foreseeable future. We may hope that the immediate future will also bring evidence of determination and success on the part of the major nuclear powers in their efforts to diminish the danger of nuclear holocaust and to reduce the already greatly excessive levels of nuclear missiles and megatons in their arsenals. It is impossible to overestimate the importance of resuming an arms control dialog leading to general progress toward these vital goals.

RESEARCH AND DEVELOPMENT ON ABM

Senator **Laxalt**. Have you left the ABM out for any reason?

Mr. **Drell**. I believe in a strong R. & D. going ahead on ABM. I don't believe that the mutual hostage relation we are accorded in the world is the ideal long-term solution.

Senator **Laxalt**. Senator Garn made the point yesterday that the original premise for going on with the ABM treaty would be that there would be a voluntary reduction or cap on offensive weapons which we have adhered to pretty well. So we have gone in no direction defensewise but the Soviets, as we all know, have gone their own way and done their own thing in complete violation of the whole basic premise of ABM to begin with.

Senator **Garn**. I was reading the other day a good deal of the testimony at the time the ABM treaty was passed: Very definitely if we don't build an ABM, they won't build offensive weapons to attack our silos if we leave them open. I will say, doctor, that in your summary I agree with virtually everything you have said except about the SUM system. We do need to modernize the bomber and other things. Let me ask one more question.

DECISION ON MX MISSILE

You said you are designing a system around the MX. Why? There are many other suggestions. If your concept is a good one, would it not make more sense to design a missile to put in that system rather than take a large 92-inch missile with its drawbacks and make a recommendation for a missile to fit that system?

Mr. **Drell**. The answer is yes. I think the MX decision is a very poor decision.

Senator **Garn**. As long as you are postulating, why don't you throw in your recommendations, because all kinds of other people are talking about road mobile, smaller missiles, and all sorts of things? It does not seem to me it is a compatible system.

Mr. **Drell**. It was my assumption that the action of the Congress based upon the recommendation of the last administration was that we were going ahead with the MX. This was a constructive way to operate, namely how is the best way to base it. I would much rather talk about the problem of what missile we should have built.

MPS BASING MODE

Senator **Garn**. The same administration recommended the MPS basing mode. I hope the Congress will not go along with that.

Mr. **Drell**. I just read the action to mean that the basing mode has not been agreed to by the Congress. It still was a matter on which we might improve on that recommendation. Perhaps I am wrong. I believe the missile decision has been made. I frankly would have preferred to see that the Navy's Trident submarine program, to which we are committed, would realize the full potential by having the 83-inch missile which fits in its tubes developed, a common missile. I noticed up until the last year of the previous administration that, in fact, was the recommendation of both the Secretary of Defense and the Under Secretary for Research and Engineering to build that common missile.

I would rather see the United States move in its land-based system toward small single RV missiles because I think what we have done is create a very high value, very high priority targets by packing 10 warheads into 1 missile. That is not the right direction to go for stability or arms control. I would much rather be discussing that problem.

I took it as a specific problem that in 1983 we are flight testing a MX missile and that program is one that we have committed ourselves to. It is a mistake.

Senator **Garn**. It would have seemed helpful to say, OK, these small submarines, this is the optimal missile to go with this. It would have been helpful in your study to do that rather than try to marry two things that I don't think are very compatible, stick that cruise missile on a small submarine.

Mr. **Drell**. A survivable basing concept which I will defend is built around having a missile, several missiles of ICBM range. The dimention of the missile, its weight, is irrelevant.

Senator **Garn**. I understand in this proposal you have abandoned the small German submarine in terms of a new submarine.

Mr. **Drell**. I personally never advocated the small German submarine. That was shown as an example of a technology that exists. I personally don't believe I ever said that we should go buy it. I think one might use that as a way of learning how to operate the system. I have always said, myself, personally, I was going to design a system for the missile. I have never recommended putting Minuteman to sea in a capsule.

Senator **Garn**. You certainly got credit.

Mr. **Drell**. I realize that. I never personally thought that was the preferred way to operate.

Senator **Garn**. I am glad to hear that because I agree with you. I didn't think that small German submarine was ever——

Mr. **Drell**. I thought originally that size was plausible. We have moved to larger areas to have more flexibility to respond to ours, yours, everyones concern about ASW.

Senator **Garn**. Would you have sufficient internal space for batteries, mission control equipment, ballast tanks, and sonar systems?

Mr. **Drell**. In our concept as opposed to the OTA and Navy concept where the launch is directly to the missile from MXA, the answer is yes and with the accuracy by external radio navigation aids, not be internal sonar the answer is yes.

NAVSTAR PROGRAM FUNDING

Senator **Garn**. The House subcommittee cut the Navstar program funding.

Mr. **Drell**. I am unhappy about that decision.

Senator **Garn**. I am too.

Mr. **Drell**. I consider that a poor decision as a way of trying to derail this proposal. I hope it has a better basis than that. I think for many reasons the Navstar system is of considerable importance and should go ahead.

EFFECT OF FUTURE ARMS CONTROL AGREEMENT ON SUBMARINE BUILDUP

Senator **Garn**. Senator Hatch, do you have any questions?

Senator **Hatch**. With the knowledge that the Reagan administration has virtually discarded the SALT II agreement as faulty, the current buildup of our defense capability is designed to get leverage to be able to negotiate a meaningful arms control agreement. So the long-term goal of this, it seems to me, is stability and reduction in both arms and defense spending.

With this in mind, it appears to me that SUM has a fatal flaw. Should we accomplish this goal and both sides agree to stop arming, then 25 years from now, it appears to me, we will have to spend enough money to replace the submarine, and this seems to be diametrically opposite to the goals we have set.

What would be your response to that?

Mr. **Drell**. If I understand your point, you are saying if we go with SUM now and we do accomplish arms control, then because the SUM has a lifetime——

Senator **Hatch**. Of 25 years.

Mr. **Drell** [continuing]. Of 25 years, it would have to be replaced?

Senator **Hatch**. Right. We would have to spend all the money to replace them.

Mr. **Drell**. The inference is that a land-based missile force might have a longer lifetime?

Senator **Hatch**. I am drawing no inference on that.

Mr. Drell. Otherwise, the general lifetime of bombers or missiles is of the order of two or three decades.

LAND BASING OF MX MISSILE

Senator **Hatch**. I have a real concern about the MX missile because I am not sure that it won't be obsolete by the time it is deployed after spending all of those billions of dollars and, of course, if it has to be based in our States, taking the land and resources and the other considerations that would have to be undertaken to deploy the MX missile, and including the multibillions of dollars which would have to be expended, at least, it seems to me, to protect our States from the impact that would occur because we should not have to carry the burden for the other 48 States.

I have not asked the question about the MX missile, but I still have reservations about SUM as well.

Mr. **Drell**. It seems to me that any system is going to be an enormous investment as a result of failure of arms control, and if we accomplish arms control and we can reduce it, it will have indeed been a waste of the money. I would like to think that every one of our nuclear systems in that sense is a waste of money, because it will never be used.

Senator **Hatch**. I think we would all agree with that.

ACHIEVING SURVIVABLE FORCES

Mr. **Drell**. We are trying to buy a defense stability based on survivable forces. The question is, What is the best way to achieve survivable forces? Indeed, if we have the wonderful success of real arms control and real reductions in 25 years, we may take satisfaction at having the survivable forces to help us get there.

We might take satisfaction in junking things that we would have been happy never to have used. I am not sure one basing or another is any different in that regard.

It seems to me that to my sense of priorities with our nuclear forces, survivability ranks very high. That is for reasons of maintaining stability, of avoiding ever using them during time of crisis.

It is my technical judgment, which is not shared by all but it is my technical judgment based on the work I have done, that if you accept the MX missile, I can't think of a more survivable way of basing it than on these submarines, for whatever limitation there is.

We have considered every possibility and I don't think any one is beautiful.

Senator **Hatch**. Thank you.

ENVIRONMENTAL IMPACT ON U.S. SHELTER SITES

Mr. **Drell**. We certainly would do it with minimum environmental and social impact on any area of the country. There are areas I have not mentioned because there are other experts on that. I am not unsympathetic with the problem.

Senator **Garn**. There is no doubt that in anything that Senator Hatch, Senator Laxalt, and I do, we are perceived as somehow being parochial simply because the proposal is in our States. I think without regard whatever to where it is going to be based, the economic impact, the major, telling drawback of MPS as proposed by the Carter administration is that it simply is not survivable as they have proposed it. It does not matter where it goes. That is not parochial; it has nothing to do with Utah and Nevada.

Mr. **Drell**. I agree with that, sir.

Senator **Garn**. We will start out either doubling the shelters before it is ever finished, the initial baseline, or you are going to talk about additional shelters in the area of 7,000 with loads in order to go with it.

The unfortunate thing, really is, again I repeat, the many years of study. It has been 5 years since I was on the R. & D. subcommittee of the Armed Services Committee and started looking at this. Unfortunately, we have dug ourselves a pit with a great deal of naiveness in the last 10 years and we are trying to figure out how to backfill it.

There are no options that stand out like a sore thumb, being, "Boy, this is really a good one." Everyone has some major drawback; that is the major thing the OTA study points out. I suppose in the end the President will have to end up picking the least of the levels. That is the way politicians are picked. [Laughter.]

Mr. **Drell**. I can see one direction emerging. If one can get there from here, it is a direction which I would hope the Presidnet might consider. The problem has grown because of the way both countries have developed MIRV's to the extent they have. Not only does that make each missile a very lucrative target because it carries so many warheads; it also means one missile can destroy many other targets.

If one could in the arms control dialog and the counting rules for SALT as they evolve, as we go ahead in negotiations, put a premium, a cost, against highly MIRV'ed missiles, in the proper way, I think we would be moving in a healthy direction for both our strategic security and arms control.

REASONS FOR OPPOSITION TO SALT II

Senator **Garn**. I could not agree with you more. The reason I opposed SALT II is that it did not place reasonable limits on anything; it legalized the biggest arms race in the world because of the sub limits. The 820 MIRV's was an increase of a 300 MIRV limit on both sides.

What treaty do you start off with by increasing the weapon you should be limiting? You are talking about legalizing 3,000 or 4,000 more MIRV's than they had before we signed the treaty. There is no way I can understand that logic.

Senator **Hatch**. At the risk of being parochial—and I think I can be parocial about it—I have always raised the issue I am not satisfied with the basing mode, if they want to base it in our State.

No. 2, I have not heard any real, definitive language concerning how they would resolve the impact on our States, assuming that is the best and most proper course of conduct to take with the MX missiles.

I have equal concerns about the SUM approach. I will have to keep studying it. I am not sure that that won't be obsolete before the great basin mode is.

Senator **Garn**. I did not mean to indicate there wasn't some serious impact. I am making a statement on the basis of technical capability before you even start assessing that, that it is not the best system to go with, before you even get beyond that.

Mr. **Drell**. My comment is that the reason I thought SALT II, despite those drawbacks, was in the interest of this country is that the fractionation and number of warheads per missile was a significant limit on the Soviet threat.

Senator **Garn**. If you had also placed a limit on the number of launchers?

Mr. **Drell**. It was only a small gain. I thought it was a worthwhile one.

I would like to see the arms control dialog go in the direction of limiting RV's. I published a proposal.

Senator **Garn**. We limited the number of holes in the ground and left the Soviets with most anything they want. That is what led to the change in the SS. Technically it is not a violation of SALT I but a violation of——

Mr. **Drell**. It was recognized that was a possibility that was open. I, personally, was not surprised by that. I worried about the way the SALT I treaty was written on those grounds.

Suppose you say that an arms control agreement such as the number of launchers plus the number of RV's is less than a number—choose a number. If building an SS–18 adds one launchers and 10 RVs, that is a very expensive missile.

I think there are directions to go with our arms control dialog.

Senator **Garn**. I suppose we can't solve the problem today.

Thank you.

SUBMARINE OBSOLESCENCE

Senator **Hatch**. The point I was making was that the shelters for the MX missile would not be obsolete in 25 years, but the submarines would be. If the subs are obsolete, it could add an additional cost.

The things that really bothers me about the SUM concept, among other things, is that it seems to me if we put our apples in that particular barrel, we are going to have some real difficulty, because everybody is going to accentuate the ability to increase technology to chase subs all over the ocean. If they do that, there are things that we can't talk about here that would tend to show that is a reality.

If they do that, then we will have really put ourselves in jeopardy by opting for this particular method of deterrence and defense.

Mr. **Drell**. Before you came in, we discussed that SUM. I will quickly go over that point on that.

First of all, I certainly don't see on the technical horizon within the decade any technology that is going to make the oceans transparent. Second, by having small submarines, many of them rather than a few, where the trailing techniques are less attractive, having reduced signatures, having them operate in waters which are acoustically more inhospitable than the deep midocean range, because they have no deep sound channel, we have tried to make the ASW problem versus the submarine maximally different from those of the Trident so that one could not concentrate ASW technology against one system alone.

It is true that with this system, like any other one, you look 20 years ahead. I know the laws of physics. I know of no way of seeing in the ocean. That system has to be prepared in a changing technical environment to defend itself by jamming, decoys or what not.

We have designed a system which take that into account. I don't think there is a free ride for any system looking 20 years ahead. It is part of the defense-offensive competition which is not going to cease with this or any other system. It is one where we should be putting in R. & D. dollars.

I think putting all that together and not having a perfect system by any means, still my conclusion is one I feel fairly secure with, in that on the grounds of survivability and accepting the MX missile as a given, I don't know a better way to base it than on small submarines.

Senator **Hatch**. Thank you so much.

Senator **Garn**. Thank you, Dr. Drell. We appreciate your time and testimony today.

Cost	(FY 80 dollars)
MX MPS baseline	$43 billion
Minuteman MPS, same size	$36 billion
MX MPS, 1990 threat	$62 billion
MX MPS, 1995 threat	$83 billion
MPS/LoADS, 1990 threat	$55-60 billion
Silos and LUA	$15-20 billion
Small submarines	$39 billion
Air-Mobile	$40 billion
Surface Ship Mobile	$43 billion

All costs for acquisition and operation to the year 2000

[Chart 1]

PREPARED STATEMENT OF W. T. FAIRBOURN

Senator Garn. Before we turn to Captain Draim, I would like to submit for the record a statement by W. T. Fairbourn, former major general, U.S. Marine Corps, former Senior Strategic Planner, U.S. Joint Staff.

General Fairbourn had made a request to testify, but so had hundreds of other individuals. We have conducted more than 5 years of hearings, particularly intensive ones in the last couple of years. They have all been closed because we have been dealing with great technical details, highly classified and, in fact, I am sure we even got beyond classification. We felt that there had been adequate time for public hearings on numerous occasions.

This is no attempt to exclude General Fairbourn; however, if we had started accepting requests of individuals who would have liked to testify, about this time next year we would still be sitting here taking testimony from all of those who would like to express their opinions.

We are certainly happy to have his statement and it will be included in the record.

[The statement follows:]

PREPARED STATEMENT OF W. T. FAIRBOURN

MAJOR GENERAL, U.S. MARINE CORPS (RETIRED)

STRATEGIC LUNACY

Early in World War II Franklin D. Roosevelt secretly commissioned the Manhattan project which resulted in the production of the Atomic Bomb.

Harry Truman ordered that the first two bombs produced be used against the Japanese in order to end World War II in 1945.

The United States secretly, continued to improve the fission weapons and to stock pile them and until 1954 enjoyed a world monopoly in atomic destructive force.

In 1954 the Soviet Union tested its first weapon, aided in its development by the assistance of captured German scientists and secrets gained from the United States. The monopoly was broken.

When the United States tested its first fusion weapon at Eniwetok. The island (Engebi) where the weapon was exploded disappeared. The force was many hundred fold that predicted. Again the United States enjoyed a quantum supremacy in the destructive force of its weaponry. The Soviet Union followed suit by developing its own weapon.

The United States later developed the solid propellent which improved the shelf life, made horizontal storage practicable, reduced time required for firing and gave many other advantages which we still enjoy.

The United States developed and deployed the MIRV (MULTIPLE INDIVIDUAL RE-ENTRY VEHICLE). The Soviets have followed suit.

The United States developed the missile submarine which is now in its fifth generation. The Soviet Union is following suit and has missile submarines deployed.

The United States is preparing to deploy the cruise missile. The Soviets have a counterpart.

The United States is preparing the MX as a "Mobile" missile. The Soviets are following suit by modifying their SS-18.

In every case except "Sputnik" which was primarily a space vehicle and related to weaponry by experiment only the United States has been the leader and Russia has been the follower. Thus history will assign to the United States the ultimate responsibility for the creation and disposition of this awesome weapon; provided that there are survivors left to record that history.

Is it not time to decide whether we wish to perpetuate human life as we now know it on this planet or whether we wish to participate in its annhiliation?

There are various estimates as to the megatonnage needed to render the Soviet Union militarily ineffective. For illustration purposes here I will use a nominal figure of 400 megatons. In our strategic configurations we have more than eight times that amount. If we add to this the amount we have in theater and tactical weapons configuration it will exceed twenty times the figure of 400 megatons.

Do we need the additional 370 megatons that MX would give us to add to the already adequate 8 x 400 tons in our strategic configuration? There is a rational which makes 3200 megatons reasonable. If you allocate 400 megatons to each leg of the triad, then add 100% to cover possible losses and place 25% in general reserve the total is 3200 megatons. This is a reasonable and conservative planning figure to assure that the nominal 400 tons can be placed on target under the most adverse situation.

Is there justification for the 370 additional megatons that MX wil produce? I find none.

This is proliferation where none is justified. At a time when the United States should be taking the lead in the reduction of nuclear weapons it is unilaterally taking deliberate action that is unjustifiable proliferation. Before the taxpayers agree to spend additional billions the Administration should be required to justify the need for the additional megationnage that will be produced by MX.

There is a considerable body of opinion that holds that the United States must be superior in both megatonnage and in warheads in order to maintain her position vis a vis the Soviet Union. This belief will not bear scrutiny. What the United States needs is adequate nuclear force to accomplish its mission e.g. to render the Soviet Union militarily ineffective. More nuclear weapons are unnecessary. Overkill serves no useful purpose. We must always keep our technology ahead but we have no need to match weapon for weapon. The requirement for the MX cannot be based on a need for additional weapons.

As a part of keeping our technology the most advanced in the world we need the MX as a replacement. We deserve the best missile in the world because we can produce it. This is our only justification for the MX but it is adequate.

To be worthwhile MX must be deployed in a survivable configuration and in geographic locations where it can accomplish its mission without hazarding the destruction of that which it is designed to protect. Deployment in the shell game configuration in the Utah and Nevada desert meets neither of these requirements. Let us address the configuration first.

The administration "perceives" that the Minuteman III is becoming vulnerable. For the moment let us accept this "perception" as being a fact. Should we replace it with a new weapon in essentially the same configuration as the present minuteman? This may be a new thought to some. It is my conclusion that a weapon that weighs 195,000 pounds, is buried beneath the level of the ground, moves once or twice a year, for a minimum of 7,000 feet and a maximum of ten miles, is hardly a mobile weapon. Further, the above characteristics all facilitate location. Whether placing the weapon in any one of twenty three prepared emplacements will effectively hide it for its lifetime is conjectural and probably can only be determined by operational testing. It is my professional opinion that neither a prudent individual or a prudent nation would risk the survivalability of such an important weapon to such an improbable future.

Let us address the proposed location of the system in the Utah-Nevada desert. The proposed location would make construction relatively simple. With the clusters located relatively close together, command, control and communication would be relatively simple. Local security in an isolated area with a sparse population would be enhanced. These appear to be all the advantages.

Turning to the disadvantages there are many. If the U.S. objective is as the Secretary of Defense Harold Brown, announced at the Democratic National Convention "To so structure our strategic forces as to convince the Soviet that they can not win a nuclear War." This means making MX survivable." The mission will not be accomplished from this location. This is the primary disadvantage and it is a fatal flaw. By the Air Force own statement 4600 warheads on this complex would destroy it. This is within the current capability of the Soviet Union (1980 Air Force statistics credit the Soviets with 6,000 warheads). Further, by the time the proposed deployment is completed it is within the Soviet capability to produce at least twice the number (12,000) warheads that they now have on hand. Construction of this particular deployment will undoubtedly motivate the Soviets to exercise this capability.

The destruction of the MX complex by 4600 Soviet Warheads delivered over a short period of time would create a post detonation situation beyond comprehension.

No one has yet tried to extropolate the direct effects of 4600 weapons delivered in a limited area to say nothing of the residual effects. Soviet bombs are notoriously dirty. These would be ground bursts intentionally and therefore, would produce the maximum possible residual effects. The author's own thumbnail evaluation of these effects leads him to conclude that considering the winds and current from west to east, at least 50% or 125,000,000 of the U.S. population would be dead. Sixty percent of the arable land of the United States would be rendered sterile and unproductive. This would destroy the nation's food supply and the world's bread basket for generations to come. The capability of the West to become the nation's principal energy source would be destroyed. The principal industrial complexes would be untenable from contamination. Human life as we know it today throughout the United States would cease to exist. It is inconceivable that any rational nation could willingly and deliberately fall victim to such genocidal conclusions and activities.

Those who disagree with the author's conclusion will argue that a nuclear strategy is successful only if the weapons are never used. No argument is offered on this point. What is seriously in question is deliberately offering the proposed MX deployment, the majority of the U.S. population,the arable agricultural land, the U.S. Industrial Complex, the energy potential of the West to destruction by a single attack untilizing the MX deployment as the aiming point.

Perhaps this aberation in national rationality would be understandable if this proposal were the only solution or even if it were the best of several solutions.

This next thought may be an over simplification but the author offers no apology. It would appear that the author's of the proposed deployment fail to understand simple principles of defense. To locate the defending forces (such as Minuteman) within the elements to be defended (i.e. population, arable real estate, etc.) made some sense when the Minuteman was not vulunerable. To continue the same general manner of deployment after vulnerability has become probable is indefensible.

Both the defending elements and the defended elements can be destroyed by a single attack.

If the Minuteman deployment is vulnerable so also is the proposed deployment of the MX just as vulnerable. The latter is not truly a mobile system (its individual weapons move once or twice a year a minimum distance of 7000'; a maximum distance of 20 miles).

Now is the time to correct the perceived vulnerability of the Minuteman and at the same time to replace it with the MX in a truly mobile configuration and incidentally to separate the defending forces from the elements of national power which those forces are defending.

There are many small islands under U.S. control in the Pacific. Example of these islands include Midway, Wake, Johnston, Howland, Baker, Christmas and on ad infinitum. Each one of these islands are capable of providing anchorage for one or more surface or subsurface vessels.

There are countless anchorages, havens and coves along the U.S. portions of the inland passage between Seattle and Alaska. Each one of these anchorages is capable of holding one or more surface or subsurface vessels.

There are numerous capital ships (battleships, carriers, cruisers and submarines) in moth balls that would make suitable platforms for ICBMs or their decoys. These could be deployed from anchorage to anchorage in a random manner. Live missiles and decoys could be moved from vessel to vessel. Weight of the missile and container (195,000 lbs) would not be a problem. Seismic radiological or thermal radiation could be easily shielded or destroyed by the greater bulk and characteristics of the platform.

The variety of combinations immediately available in such an array of forces and facilities is mind boggling.

Deployment need not await the availability of MX. It could be started now with the Minuteman in storage and the vessels in moth balls. The MX missile could be phased into the system as it becomes operational.

To continue the development of a system that is already vulnerable, that cannot be fully deployed for ten years, that cannot accomplish its mission when deployed, that increases the attractiveness of the United States as a target; while failing to investigate reasonable concepts such as presented herein is in the author's judgment STRATEGIC LUNACY.

HYDRA-LAUNCH FOR MX MISSILE

STATEMENT OF CAPTAIN JOHN E. DRAIM, USN (RETIRED), FORMER NAVY RESEARCH AND DEVELOPMENT MANAGER

SEA-BASING STRATEGY

Senator **GARN**. Dr. Draim, would you like to proceed with your testmony?

Captain **DRAIM**. I would like to note in starting, if we had one more naval aviator at the table we would have a majority.

It has been a little over a year since I appeared before the committee, so the basic information that I had to convey, of course, is already a matter of record.

In the intervening year, of course, some new developments have occurred. Of course, the MX system has expanded its budget and come under a lot of criticism, but that is not the purpose of my being here. I wanted to convey, I think, some of the feelings of senior retired naval types regarding sea basing in general as a strategy, and whether this be done on surface ships or submarines, I think a lot of the same principles apply.

I would say in starting out, just to flesh out the picture a little bit, I am going to depart from my script here, if it is satisfactory.

Senator **GARN**. We will include your entire statement in the record.

SURFACE SHIP BASING

Captain **Draim**. I think some of the points which people raise about surface-ship basing have to be addressed. I would like to attempt to convey some of the opinions of myself and some other naval officers.

Surface ships certainly cannot hide as easily as submarines because they can't submerge; however, surface ships do and can have a high degree of survivability if they are operated properly. Particularly, being missile carriers, say, MX missiles with extremely long range, they certainly would not be exposing themselves to the same degree that they would in a task force in the Mediterranean or at the very gates of the Soviet Union. They can stay pretty far removed from Soviet air and naval bases. They can derive support from our own base structures and so forth; but they do have the advantage of being able to take missiles to sea rapidly.

SL-7 SURFACE SHIP

To give you an example, I just completed a study for OTA. I looked at a large number of different types of surface ships which are potential carriers. One of the classes which has actually a high degree of applicability here is the same ship which is now being procured for the Rapid Deployment Force, the SL-7. This is a fast ship, 33 knots; it can outrun all of the Soviet trailer, intelligence-carrying ships, the AGI's. It has high endurance; it can stay out literally for months at sea. It can operate efficiently at lower speeds; it has diverse capability to break trail with other ships.

VULNERABILITY OF SURFACE SHIPS

I would like to address vulnerability a little bit—I realize that we are going to be constrained by security. The statements that have been made regarding the vulnerability of surface ships to satellite ocean surveillance, I believe, should be very, very carefully evaluated so that instant credibility is not given to satellites being 10 feet tall and able to continuously keep surface ships identified, sorted out and tracked on a minute-by-minute basis. This would be required if these ships were to be sunk in a coordinated attack.

Now, if they are not sunk almost instantaneously, say, within a very short period of time, in minutes, the remaining ships could get their attack off. Surface ships do have a much greater degree of mobility, obviously, than the MX/MPS does, for example.

I think the surface ship has not been studied to the degree that it should have been. Some fairly extensive studies would show, I believe, that for the near-term surface ships make a very, very viable missile base.

I believe that the surface ship in the 1990's is going to be increasingly under pressure from the ocean surveillance satellites and other types of weaponry; but the advantages of doing it on surface ships are that it is a near-term interim approach at a lower cost.

Now, we can use existing ships. If floating launch techniques are used, basically you get for that a free launcher; you get the water; you get earlier IOC's, earlier FOC's, and you have to compensate for this added degree of vulnerability from the submarine by using probably more missiles.

As Dr. Drell has told you, he is not using 200 missiles because the submarines are given credit for being more survivable. He is using something over 100. The MX/MPS is counting on having attrition, so they are using 200 missiles. As a starting point for my look, I also used 200 missiles, recognizing my vulnerability was going to be greater than the submarines.

SURVIVABILITY OF SURFACE SHIPS

As it turned out, in the study that I did I concluded that it would be less vulnerable than the MPS. There are a lot of tactics and operational features which can be used to increase the survivability of surface ships in light of the threat.

I agree with Dr. Drell that barrage attacks, whether they be against submarines or surface ships, are probably the least likely type of threat that these systems will have to contend with. I think that the real threat against sea-based systems is other sea-based systems, such as submarines, surface ships, and if the aircraft have long enough range to reach them, the aircraft.

DEFENSE OF SURFACE SHIPS

Senator **Garn**. That brings up a question I want to ask you. With a surface ship, how do you defend it? You talk about trying to hide it; that is a much more difficult problem. If we stick an aircraft carrier out there, we defend it with a task force. The submarine can go by itself and its invisibility in the water protects it.

I really can't conceive of a concept where we have undefended surface ships with MX missiles floating around on it. It seems to me the vulnerability is so large. Then if you start putting a task force around it to protect it, you have instantly given away its location.

The Soviets are smart enough to figure that out. Why are they protecting this old surface ship? That is a very major concern.

Captain **Draim**. The ship we were proposing was basically in the class of a fast container ship but had added protection in the form of deck guns and probably a helicopter landing pad, so that it would not be without its own protection. In addition, if it were under trail or observation it would be operating in such an area of the ocean—most probably we would favor our side of the ocean rather than the other side so that their ranges would be much greater—they would have to invest more in getting trailers over.

Even if they did latch onto one of these ships at that time, you might wish to call in an air unit from one of our nearby air bases or a submarine from one of our naval bases to help that particular ship.

Senator **Garn**. It seems to me with surface-to-surface missiles, surface-to-air missiles, smart torpedoes and all of those sorts of things that it would be almost impossible to defend.

Captain **Draim**. It can be difficult to defend it, but they have to find it first. The thing is that if they are going to have a coordinated attack against this surface ship system, they are going to have to find all these surface ships and have them targeted, identified, tracked, and run this attack in a coordinated fashion so that they don't slip up and miss a few.

Senator **Garn**. Again, in a sophisticated tracking that occurs today, you have container ships that are not carriers; they have a destination. Not only would it be too difficult—and I used to track ships, too.

Captain **Draim**. I used to track ships, too.

Senator **Garn**. We did not look for subs when we were over in Japan. We tracked surface shipping off the east coast of China for a period of time. It really was not too difficult and that was 20 years ago. The technology has improved so dramatically.

Get a ship out there steaming in circles: that is suspicious. Why is it not going someplace?

Captain **Draim**. I appreciate your concern. Of course, I have concerns along the same line and I am sure that as time goes on the situation will not be as good for the surface ship. That is why we are saying it is an interim, quick solution for probably the 1980's.

ARMS CONTROL IMPLICATIONS

Senator **Garn**. Let me ask you one more question that ties in with this: What about the arms control implications then? The only solution to this madness is an arms control treaty that is verifiable.

How are you going to convince the Soviets that container ships are verifiable? You say if you have a large number of container ships out there that makes them less vulnerable and solves some of the problems I have just been talking about. It also increases the problem of verification, does it not?

Captain **Draim**. It probably does. How do we know that they don't have container ships also, with missiles?

Senator **Garn**. I assume that the Soviets have everything. It is just like Dr. Drell was talking about verification of submarines. We got recently surprised by a new submarine that our intelligence did not do too well on until it was ready to drop in the water. As much as I hear about all the things we know about what the Soviets are doing, I expect the worst, which has always proven to be true.

Captain **Draim**. I think, to make forward progress here, regardless of which type of sea-based approach is made, whether it be SUM or surface ships, an interim system, maybe eventually leading into SUM or putting the missiles on faster ships like SES's, that the vertical floating launch is one of the keys to this.

Now, I have been observing the Soviets for many years in their development programs. I can assure you that they are not overlooking the possibility of the floating launch. In fact, all of their SLBM systems today are based on a floating launch and not a straight pop-up.

PROBLEMS ASSOCIATED WITH HYDRALAUNCH

Senator **Garn**. Aren't the problems of command and control, launch time, accuracy, compounded by a hydralaunch?

Captain **Draim**. As a matter of fact, I think Dr. Drell will agree with me that using the modern techniques such as ground-based

GPS beacons or even satellites, the accuracy is virtually just as good for sea-based as for land-based.

Senator **Garn**. What about timing of the launch to solve the fratricide problem?

Mr. **Drell**. I think the command and control problem requires you to be near the coast where the ground beacons are. It is not whether you drop them off the side of the ship or they come up from the submarine that I am concerned with. I am concerned about the fact that because the submarines are invisible and near the coast, you have a ground beacon system for accuracy if we lose NAVSTAR.

If you are away from the coastline, where do you get your accuracy?

Senator **Garn**. I am not talking technically. There are a lot of things that can be done technically. I am talking about the practicality of getting over the side of that ship into the water, timing those launches to solve the fratricide problem.

It seems to me that is an incredible thing.

Captain **Draim**. I don't see that that is a problem. As far as getting them over the side, there are a variety of ways that are demonstrated here.

Senator **Garn**. How many times in your Navy experience have you been told by the scientists and so on that this worked and it didn't?

Captain **Draim**. Quite a few times.

Senator **Garn**. How many airplane systems have you and I seen fail that have been tested and used and used for years? How many times have you come back with that yellow sheet and written up a complaint and when you get back to the airplane they say, "Ground check OK"? Wonderful; it worked on the ground; but it did not work in the air.

These were relatively simple systems. You know exactly what I am talking about as a naval aviator or Air Force pilot.

Captain **Draim**. Sure. However, we are both here.

Senator **Garn**. That is true, because it is safer than driving cars. There is no doubt about that. But that is not my point.

I just can't accept passing them off because it is technically feasible. I don't disagree with you that it is technically feasible. I am talking about how it actually works.

I see some very complex problems in the execution, not the technical capability to do it in either of your systems, but the execution.

Captain **Draim**. That is why we ought to get started working on it.

MANPOWER PROBLEMS

Senator **Garn**. We have another problem that ties in with that, and you know what I am talking about, too. The last time I visited an aircraft carrier I talked to the captain and talked about how many of his crew were brand new on every cruise, and training of these 18- and 19-year-olds on some systems that are far more complex then when you and I were using them.

So you get into the manpower problem. Again, I am talking about application, not technical capability. I won't disagree with you, technically there are a lot of things we can do.

Captain **Draim**. I would like to draw your attention to this statement of mine, where there are four telegrams which were sent to Mr. Haynes of the Utah County Republican Executive Board. One was signed by Thomas Moorer, admiral, U.S. Navy, (retired), another by Vice Admiral Raborn, another by Adm. George Miller and another by John Alvis, who, you might remember, was the F-14 program manager.

I believe these gentlemen's opinions should be taken into account.

ASW

Senator **Garn**. We do give them account. It is like me conducting antisubmarine warfare. I can say I was an ASW pilot and my opinion should be worth something. I am not discounting their ability, but when people are removed from a situation, in some cases for many years, and relying on something that happened sometime ago, and have not had the ability to have updated briefings and the latest available technology explained to them, I think you have to place their opinions in that context as well.

I have had opportunities now for 5 years to sit through the highest levels of briefings and I still have a lot of questions with that kind of background, still a lot of questions. So when you get somebody who, fine, has an opinion, it is based on some past background, I would hate to stand up and give my opinions based on my background in ASW, even though it gives me some foundation.

There have been a lot of changes in the ASW since I was technically proficient in those systems. I would not propose to say I am an expert on ASW anymore. I may have been at one point but that was long ago, so I just put it in that context. I don't discount their opinions, but I think you have to put them in proper context.

With all due respect to my own party and chief, who is here in the room today, I don't know that the opinion of the Utah Republican Central Committee should have any great impact on the President of the United States. They are all friends of mine but I know of no particular technical background in which to base a decision as far as their opposition to its being in their State and affecting their communities, that part of it.

But on the technical aspect I really have to say that I don't think you should make a decision on the basis of Utah County or Ohio or anybody else when we do have people with some technical background from which to talk about it.

Captain **Draim**. I think, going into the main drawback, the submarine system—and I would have to class in here Poseidon, Trident, as well as SUM—has been studied in great depth by the Navy. The land-based systems of all varities—land mobile, hard silo and so forth—have been studied in great depth by the Air Force. Surface ship missile basing has really been an orphan. I think it has been put to bed many times by a lot of misrepresentation.

Senator **Garn**. Road mobile is a good system. It has a political problem. I would much rather have a missile going down the freeway than some of the chlorine tankers and other toxic chemicals in trains that derail in towns, where there is a great deal more possibility of having an accident from common, everyday things, than a missile which will not explode, in no way will they explode, even in an accident on a highway.

I am not going to attempt to sell that to the American people because I think it is impossible to sell. It is a political problem. If you really want a survivable system, put it on the roads.

Captain **Draim**. One of the reports that came out in this intervening year was published by the Department of Defense—you probably have seen this, Senator?

Senator **Garn**. Yes.

ADVANTAGES TO MPS SYSTEM

Captain **Draim**. I took exception to quite a few of the things that were said in here. I am sure that some of the people out there in the West would question some of the statements, also.

In the summary page they make this statement:

> The reason for choosing the MPS is clear. There are no negative features and two positive features. MX/MPS provides an independent triad survivability mode and extended endurance. It is satisfactory on all other counts.
>
> Alternative concepts are all judged to be inferior in one or more of the evaluation criteria.

Now, to me, and looking into how this document was generated, it appears that the main goal of this was to sell the MPS, not really to evaluate alternative options.

Let me illustrate a little farther, that in the section regarding Hydra, they make statements like, "Missiles for nuclear warheads floating unattended in ocean waters introduces an unacceptable hazard to navigation for world shipping."

When we are carrying them aboard ships and not launching until we get a command, I don't see where they are floating for months on end, creating hazards to navigation.

I think there is so much misrepresentation in some of these system descriptions that they are almost worthless. If you want to read some light fiction, I would recommend this document.

Senator **Garn**. There is plenty of that around on many subjects—light fiction, that is.

Captain **Draim**. That is true, but when it is put out by the Office of the Deputy Under Secretary of Defense, it is not his job to be a novelist.

Senator **Garn**. He is just following his Commander-in-Chief.

SL-7 CAPABILITY

Captain **Draim**. The other things about the SL-7's that I think are quite interesting, are that they can carry quite a few missiles, and you could, if you wanted to, take those eight ships which are in existence right now—I think we are buying them for something like $35 million apiece—those eight ships themselves could carry probably 200 missiles or more.

I am not saying that you would want to concentrate all those missiles to that degree. In fact, my study shows you need more surface ships than just eight.

The point is that this can be done with existing ships and can be done quickly. If we want to get some heavy firepower out there in a mobile-dispersed mode which will worry the Russians, we can do it in this decade with surface ships. If you want to wait until 1990, we can go with some of the others.

NAVY OPPOSITION TO SEA-BASED PROGRAMS

Senator **Garn**. Why do you feel the Navy is so opposed to sea based? Obviously, they would like more Tridents. They would like the D-5 and improvements in their current capability and expansion of the program. So they are opposed to sea based, but they very strongly believe in the Triad, maintaining their part and accelerating it, but not wanting to take another part of the Triad.

Captain **Draim**. I think the main reason is the dollars; they don't want to have to pay for it.

Senator **Garn**. It is not going to detract from the Navy's budget if the Congress decided to go that way. No matter where it is, Congress has to appropriate additional money for that system. The Navy is not going to pay for that strategic system.

Captain **Draim**. They might not look at it that way. They had to take pretty much out of Navy funds to start Polaris.

Senator **Garn**. You have an entirely different debate going on here.

Captain **Draim**. I think these tend to drain from the total Navy capability.

Senator **Garn**. I don't think the Air Force feels it is draining from their other capability.

Captain **Draim**. Actually, I would have no objection, Senator, to working with the Air Force, and I am sure that waterproofing the missile or putting it in a capsule could be done quite easily, and could be done by Air Force crews. It would not have to be done by Navy crews.

Senator **Garn**. That is not my point. My point is simply that all the active duty command structure of the Navy, although they will fight for every dime they can get to improve Trident, none of them is advocating additional sea based. They feel they would like to go to Trident—D-5, 14 warheads and improved capability in that manner—rather than doing away with the land-based leg.

That is my major objection. I am not willing to take the chance, even if your system works. The bottom line with me is that I am not willing to take that chance on effectively doing away with one leg of the Triad, particularly in light of the B-1 decision.

You see, I think the President before made a serious mistake in 1976, obviously because of the campaign going on. If he had made the decision to build the B-1 and build the MX missile at that time, rather than deferring it until after the election—then we know what we got into with the Carter delay on one and cancellation of the other—this vulnerability would not be nearly as large, because even in the worst case, as bad as it is, you can stuff MX in the Minuteman silos and the survivable silos would have ten warheads, so there would be a marginal amount of additional retaliatory capability with MX without having decided on a basin mode—marginal, I admit, but at least some additional deterrent power.

Captain **Draim**. I don't advocate doing away with the land-based missile.

Senator **Garn**. Effectively, you have with the Minuteman III.

Captain **Draim**. The MPS system in itself is the one I really have objection to.

RATE OF DESTRUCTION FOR LAND-BASED SYSTEM

Senator **Garn**. I do, too, but my point is that we have a Minuteman force that is vulnerable and they are not going to allow that, so, effectively, if you don't do some upgrading in some manner of the land-based system, you have abandoned it. You have simply said whether there are 1,053 land-based ICBM's sitting there, 85 or 92 or 93 percent of them will be destroyed in the first strike; therefore, you have abandoned it, effectively, whether you have made that decision publicly or not, by going to some other alternative rather than land-based enhancement.

That is my major objection to going to sea with more than half of our offensive capability at sea now—simply the old cliche, you are putting all your eggs in one baket, and that disturbs me.

If either one of your systems works as well as you hope it will, it is a chance that I, personally, am not willing to take.

CONTINUATION OF TRIAD SYSTEM

I think we need to continue the Triad. I agree with Dr. Drell, we need a new land-based bomber because we have seriously weakened that leg of the Triad.

Anybody who thinks the B–52 is a viable bomber to the year 2000 is kidding himself. It will fly. DC–3's still fly, but I have serious question about their offensive capability.

Mr. **Drell**. It would be nice to maintain a land-based force, but without a cap on MIRV or without a cap on employment, there is no survivable land-based basing mode. That is a problem we are contending with. The ABM, the MPS, neither one has met the requirements that you pose.

UNCERTAINTIES IN HYDRA

Senator **Garn**. There are uncertainties in the Hydra that I think would work best in the existing Minuteman silos, but I don't think the uncertainty is as great as the lack of survivability of the submarine. I am betting more on that exo-atmospheric system coming through than that the Soviets won't have a breakthrough in ASW, becaue I believe they will.

I can't find anybody who hasn't found they have done some breakthroughs more rapidly than our intelligence anticipated they would for a couple of decades.

Mr. **Drell**. The point about the exo-atmospheric is that there is a discrimination and an environmental problem which one knows is a problem that there is no way of handling, and there are physics limitations as to what one can do in the water.

With regard to the submarine, this is a technical judgement. Honest people can disagree on that. There is strong and clear disagreement. I want to hedge my bets every bit as much as you do. Technically, I find much greater confidence, given the limitation in the laws of nature and behavior of water on the ASW problem.

As a technical man, I would rather handle that problem, is what I am saying.

Senator **GARN**. If I could get to the design bureau of the Soviet Union and find out what is going on, I might share your opinion.

Captain **DRAIM**. I would like to suggest maybe we should reconsider our tradition of the amount or the percentages of land-based and sea-based mix.

Here is a study from Dr. Sullivan showing the footprints of nuclear war. Adding 4,600 additional aim points on here will pretty well cover in the remaining areas. We have an option right now to do that by putting the MPS in and essentially making that just one additional battleground in nuclear world war III.

MPS AND SEA-BASED OPTIONS

Senator **GARN**. Senator Laxalt and I both have pointed out the deficiencies of MPS. I don't feel that is a good option. I also don't feel the sea-based option is good.

Essentially, where I come down, I think we have seen a decade of deterrence where the Soviet Union has used our naiveness, incredibly so. The earlier talk was the hope that not having an ABM system, the Soviet Union would not build an offensive system. I think they decided what their plans are without regard to what we do.

It has essentially been an arms race going on for the last decade. We unfortunately, have not been the persistent one, despite what you hear in the news media. The facts are, we made a unilateral decision not to deploy more than 1,053 ICBM's at the time the soviets had 500. We have kept that unilaterally without regard to any treaties. They have not, and they have gone well beyond 1,500.

We unilaterally cancelled the B-1. They continued to build the Backfire.

No one can find me one single example of where, with the unilateral reduction of arms on our side, the Soviet Union followed suit. They simply have not done that. So we have left ourselves undefended in the hope they would have good will and not build these weapons. They built the 17, the 18, the 19, deliberately designed for hard-target kill capability, and for one purpose—to wipe out our land-based ICBM leg.

The reason I want to stick with the land-based leg is because of the fact that that is the greatest threat to the Soviet Union; it is the most accurate and that is why they have based their offensive plans on knocking out our most effective deterrent to them. Otherwise, they don't need an SS-18 to destroy submarines. They are not even targeted at them at all.

Captain **Draim**. I think by sea-basing them we would finesse their strategy. We would force them to completely rethink their strategic force structure and expend very many rubles, which would be dollars to us.

SOVIET VIOLATIONS OF SALT I AND II

Senator **Garn**. We have ignored their violations of SALT I and SALT II. The testimony I read the other day said if there was a massive buildup in defensive weapons—this is Scoop Jackson talking, Melvin Laird, Fulbright—we would consider that a violation of the treaty. Those are not my words; that is in the testimony I read the other day.

They have massively violated. They can play the game. We did not dot every "i" and cross every "t". We ought to sign a treaty like the Israelis do—sign the treaty; if they don't dot every "i", they violate it. We let them get away with testing SAM-5 and battle management. We let them encrypt telemetry, which is prohibited. There have been many tests and they say, "All right we will quit." By that time they have obtained the technical data they needed.

The point is, how long are we going to remain naive?

The testimony shows if we go full speed on any of these options, we have a vulnerability gap for 10 years, and we hope they are nice guys and they really don't want to attack us, which I don't think they do. I think they want to use overwhelming superiority to continue their wars of attrition and intervention around the world and isolate us with merely the threat of power.

I think we have to be realistic and we have to recognize that we have badly failed.

On the record, I don't know how anybody can dispute it; the facts are there and either amend or leave the ABM Treaty; start having some passive defenses; work toward a SALT treaty.

It seems to me, rather than an ABM being a destabilizer, it might have more of a positive impact on reduction of offensive arms, if we say, well, if the Soviets decide we can't get enough through and it is costly to continue to try to build more and more offensive weapons to penetrate that ABM system, maybe now is the time to stop.

I share a completely different view of ABM. I think it would be constructive to push both countries toward a viable SALT treaty, rather than leaving ourselves undefended. It is the old game—if we give up our shield on the hope they would not build a better spear, we are stupid. We have our shield on the ground and they have built a better spear.

I think it is time to bring up the shield again and say we are going to protect ourselves defensively, and maybe it is time we both quit building spears or at least start cutting them down.

I think we must also, very clearly, if not in an announced policy, let the Soviet Union know there is a distinct possibility that those silos will be empty, that they can't count on our being stupid enough to sit here and absorb a first strike. That is a deterrent, too.

With a strong President like Reagan, if we start taking some of these steps and let the Soviet Union know we don't have a patsy for a President anymore, who is willing to give away the candy store, maybe we can finally go to the ultimate step, which is a reasonable SALT treaty. Otherwise, I see sheer madness on both sides.

Unfortunately, the last 10 years we have not participated in the madness to convince them that it is a no-win situation.

I did not intend to make such a speech, but I do think we have to modernize the bomber threat. We have to improve command and control. We have to improve our early warning and proceed with Trident II and D–5 missiles and improve Trident capability as well.

Mr. Chairman, I am glad you are back. I will get off my soap box.

Senator **Laxalt** [presiding]. Where are we?

Senator **Garn**. We are through.

Senator **Laxalt**. I apologize. I had a very important meeting with our leader on other matters in connection with our reconciliation and block grants.

Is there anything further that we have? If not, I want to thank all those who have participated in the discussions we have had the last several hours. They have been extremely helpful to the members of the subcommittees, particularly the two who are present here today.

We will compile findings very quickly. We will also decide whether or not a report will be forthcoming and in what form.

I think that it is the responsibility of these subcommittees to assimilate and distill the findings that we should make, make them available to the committee, Secretary Weinberger and also the President.

I rather think the members of our committees, after consultation with us, will concur.

We thank you very much.

PREPARED STATEMENT

We will insert the prepared statement of Captain Draim in the record at this point.

[The statement follows:]

HYDRA-MX

SEA-BASED DEPLOYMENT OF FLOATING-LAUNCH MISSILES

PREPARED STATEMENT OF CAPT. JOHN E. DRAIM, USN (RET.)

THANK YOU, MR. CHAIRMAN.

IT WAS A LITTLE OVER A YEAR AGO, ON MAY 7 1980, THAT I APPEARED BEFORE THIS COMMITTEE AND SUBMITTED A STATEMENT ON THE PROPOSED MX BASING. SEVERAL DEVELOPMENTS HAVE OCCURRED DURING THE INTERVENING YEAR, NONE OF WHICH WOULD CAUSE ME TO REVISE MY PREVIOUS VIEWS. TODAY, THE AIR FORCE'S MX/MPS EFFORT HAS EXPANDED TO A ROUGHLY $2½B PER YEAR EFFORT, ALTHOUGH A FINAL DECISION ON BASING HAS YET TO BE MADE. ENVIRONMENTAL IMPACT HEARINGS HAVE BEEN HELD IN THE WESTERN STATES: THE STUDIES AND ASSUMPTIONS ON WHICH THEY ARE BASED HAVE COME UNDER MUCH CRITICISM, AND AT LEAST ONE LAWSUIT HAS BEEN FILED ON ENVIRONMENTAL GROUNDS.

IN DECEMBER OF LAST YEAR, THE DEPARTMENT OF DEFENSE COMPLETED A "STUDY" OF MX ALTERNATIVES ENTITLED "ICBM BASING OPTIONS - A SUMMARY OF MAJOR STUDIES TO DEFINE A SURVIVABLE BASING CONCEPT FOR ICBM'S." ALTHOUGH DATED DECEMBER, 1980, THIS BOOKLET WAS RELEASED LESS THAN A MONTH AGO. IT CONFIRMS MY OPINION, EXPRESSED IN LAST YEAR'S HEARINGS, THAT "INSUFFICIENT ATTENTION HAS BEEN GIVEN TO ALTERNATIVE STRATEGIC MISSILE SYSTEMS AND LAUNCH TECHNIQUES." THE PRIME PURPOSE FOR THIS BOOKLET, IN MY OPINION, WAS TO PUT TO BED ANY SERIOUS CONSIDERATION OF ALTERNATIVE SYSTEMS AND THUS TO CLEAR THE WAY FOR THE MX/MPS "SHELL GAME". RETIRED AIR FORCE GENERAL RUSSELL DOUGHERTY PERHAPS TOUCHED UPON THE REAL RATIONALE FOR PUBLISHING SUCH A DOCUMENT WHEN HE STATED IN A RECENT ISSUE OF AEI FOREIGN POLICY AND DEFENSE REVIEW:

> "...THE GREATEST THREAT TO MX IS NOT THE SOVIET UNION BUT A SMALL GROUP OF NUCLEAR DEFENSE PLANNERS AND STRATEGIC WEAPONS DESIGNERS."

THE PREFACE OF ~~THE~~ REPORT ITSELF STATES THAT IT IS DESIGNED TO "MAKE AVAILABLE TO THE GENERAL PUBLIC AN UNCLASSIFIED SUMMARY OF THE RATIONALE AND SYSTEM EVALUATION CONSIDERATIONS THAT LED THE U.S. TO DECIDE TO DEPLOY THE MX INTERCONTINENTAL BALLISTIC MISSILE (ICBM) IN A MULTIPLE PROTECTIVE STRUCTURE (MPS) BASING MODE." VARIOUS LAND-, SEA-, AND AIR-BASING MODES ARE PRESENTED IN THE FORM OF A CONCEPTUAL DRAWING AND AN EVALUATION MATRIX. IN REVIEWING THE VARIOUS SEA-BASING OPTIONS, I WAS STRUCK BY THE DEGREE OF BIAS AND MISREPRESENTATION, EVIDENT IN THE SYSTEMS DESCRIPTIONS. FOR OVER TWENTY YEARS, I HAVE BEEN ADVOCATING THE USE OF THE VERTICAL-FLOATING (HYDRA) LAUNCH TECHNIQUE, IN CONJUNCTION WITH EITHER SURFACE SHIPS OR SUBMARINES.

MISSILES WOULD REMAIN UNDER POSITIVE CONTROL, ABOARD SHIP, UNTIL A VALID LAUNCH COMMAND WERE RECEIVED. AT THAT TIME, THEY WOULD BE DROPPED OVERBOARD AND IN LESS THAN TWO MINUTES (THE TIME REQUIRED TO CLEAR THE SIDE OF THE SHIP AND TO SELF-ERECT) THEY WOULD BE FIRED. THIS DOD DOCUMENT, HOWEVER, DESCRIBES

THEIR VERSION OF THE HYDRA SYSTEM USING THE FOLLOWING TERMS - "SURREPTITIOUSLY DROPPING THE MISSILES INTO THE OCEAN"; AND, "MISSILES WITH NUCLEAR WARHEADS FLOATING UNATTENDED IN OCEAN WATERS INTRODUCING AN UNACCEPTABLE HAZARD TO NAVIGATION FOR THE WORLD'S SHIPPING". THE BOOKLET IMPLIES BY ITS TITLE THAT THERE WERE MAJOR STUDIES CARRIED OUT ON THESE ALTERNATE BASING CONCEPTS. I QUESTIONED AN OFFICER IN THE PENTAGONABOUT THE 'MAJOR STUDIES' IN THE HYDRA SEA-BASING AREA, AND HE COULD FIND NONE. I ASKED HIM WHO PREPARED THE ICBM BASING OPTIONS BOOKLET, AND WAS TOLD "SOME CONTRACTOR EMPLOYEE". I LEAVE IT TO YOUR JUDGMENT AS TO HOW OBJECTIVE THE AIR FORCE CAN BE IN EVALUATING SEA-BASED ICBM SYSTEMS. (I HAVE MY OWN OPINION.)

BEFORE LEAVING THE SUBJECT OF THIS DOCUMENT"ICBM BASING OPTIONS" I SHOULD LIKE TO QUOTE TO YOU FROM THE SUMMARY PAGE OF THIS REMARKABLE PUBLICATION:

> "THE REASON FOR CHOOSING THE MX/MPS IS CLEAR. THERE ARE NO NEGATIVE FEATURES AND TWO POSITIVE FEATURES- MX/MPS PROVIDES AN INDEPENDENT TRIAD SURVIVABILITY MODE AND EXTENDED ENDURANCE. IT IS SATISFACTORY ON ALL OTHER COUNTS. ALTERNATIVE CONCEPTS ARE ALL JUDGED TO BE INFERIOR IN ONE OR MORE OF THE EVALUATION CRITERIA."

I VENTURE TO SAY THERE ARE QUITE A FEW CITIZENS IN UTAH AND NEVADA WHO WOULD QUESTION THE STATEMENT THAT THERE ARE NO NEGATIVE FEATURES TO MX/MPS! FURTHER, I QUESTION THE ASSUMPTION OF EXTENDED ENDURANCE, WHEN EACH AND EVERY SHELTER WILL REMAIN AT A KNOWN POSITION AND THERE ARE NO SALT LIMITS ON SOVIET WARHEADS TO PREVENT THEIR ATTACKING ALL 4600 SHELTERS. THE FACT THAT RADIOACTIVE FALLOUT FROM A LARGE SCALE THERMONUCLEAR ATTACK ON MX FIELDS IN UTAH AND NEVADA, WOULD DRIFT OVER THEEASTERN HALF OF THE U.S. AND CAUSE MILLIONS OF FATALITIES IS APPARENTLY NOT CONSIDERED TO BE A NEGATIVE FEATURE.

IN DECEMBER OF LAST YEAR, I COMPLETED A ONE-MONTH STUDY FOR THE OFFICE OF TECHNOLOGY ASSESSMENT ON BASING MX ABOARD SURFACE SHIPS. TECHNICAL FEASIBILITY HAD ALREADY BEEN DEMONSTRATED BY NUMEROUS FLOATING LAUNCHES CARRIED OUT BY THE NAVY IN THE EARLY 1960'S, AND BY THE USSR WHO USE THE FLOATING LAUNCH METHOD FOR THEIR OPERATIONAL SLBM SYSTEMS. DEPENDING ON WHETHER EXISTING SHIPS OR NEW CONSTRUCTION SHIPS WERE USED, AND ALSO ON THE TYPE OF SHIP SELECTED, THE TEN-YEAR TOTAL SYSTEM COSTS COULD BE HELD BELOW THE MOST OPTIMISTIC ESTIMATE GIVEN BY THE AIR FORCE FOR MX/MPS. AND, THE COSTS WERE FAR BELOW THE HIGHER FIGURES ESTIMATED BY GAO AND OTHER AGENCIES. ALTHOUGH NOT AS SURVIVABLE IN THE LONG-TERM AS A SUBMARINE SYSTEM, A PROPERLY CONFIGURED AND OPERATED MX SURFACE SHIP FORCE SHOULD HAVE A MEAN SURVIVABILITY MEASURED IN DAYS IF NOT WEEKS- MORE THAN SUFFICIENT TO COUNTERATTACK OR PERFORM A RETALIATORY FUNCTION, SHOULD THE DETERRENT VALUE OF OUR COMBINATION OF STRATEGIC FORCES FAIL TO DETER AN ENEMY ATTACK. SURFACE SHIP DEPLOYMENT OF MX CAN HAVE MAJOR ADVANTAGES IN THE NEAR TERM AS AN INTERIM, OR "QUICK-FIX" SOLUTION TO THE STRATEGIC IMBALANCE. IT PERMITS VIRTUALLY UNLIMITED MOBILITY AND PROVIDES MUCH MORE OPPORTUNITIES FOR CONCEALMENT AND DECEPTION THAN IS GENERALLY APPRECIATED. SHIPS WOULD BE OPERATED OUT OF RANGE OF SOVIET AIRCRAFT, AND AT THE EXTREME LIMITS FOR SOVIET SHIPS, WHILE REMAINING WITHIN RANGE OF U.S. BASES FOR AIR AND NAVAL SUPPORT.

SATELLITES HAVE OFTEN BEEN CITED AS THE MEANS FOR ENSURING THE VULNERABILITY OF THE SURFACE SHIP. WHILE IT IS TRUE THAT OCEAN SURVEILLANCE USING SATELLITES HAS GREATLY IMPROVED THE SITUATION WHICH EXISTED DURING THE BATTLES IN THE PACIFIC DURING WORLD WAR II, THERE IS YET A LONG WAY TO GO. AS WITH ANY WEAPON OR SENSOR SYSTEM, THERE ARE COUNTERMEASURES AVAILABLE AGAINST AN ENEMY'S SATELLITES. ADDITIONALLY, THOUSANDS OF "FREE DECOYS" EXIST IN THE FORM OF OTHER SHIPS AT SEA, ALL CONSTANTLY IN MOTION. THE CONFUSION FACTOR IS HIGH, AND FOR THE NEXT DECADE AT LEAST, SATELLITES WILL NOT BE ABLE TO DO A 100% EFFECTIVE JOB AT DETECTING, IDENTIFYING, AND CONTINUOUSLY TRACKING AND TARGETING ALL THE SHIPS AT SEA WHICH COULD BE MISSILE CARRIERS. SHIP AND SUBMARINE TRAILERS CAN ALSO BE COUNTERED, AND IT IS HIGHLY UNLIKELY THAT ALL THE DEPLOYED SHIPS COULD BE ATTACKED AND SUNK SIMULTANEOUSLY. UNLESS AN ENEMY HAS THIS CAPABILITY, THE REMAINING SHIPS WOULD ALWAYS BE THERE TO MOUNT A COUNTERATTACK.

A STRATEGY FOR DEVELOPING AND DEPLOYING SEA-BASED ICBM'S CAN AND SHOULD BE DEVELOPED IMMEDIATELY - PROBABLY IN CONJUNCTION WITH ANY LAND-BASED OPTIONS PRESENTLY UNDERWAY. SALIENT FEATURES OF SUCH A PROGRAM ARE:

(A) AN EXERCISE AT SEA SHOULD BE SCHEDULED USING DESIGNATED MERCHANT SHIPS CURRENTLY AVAILABLE AS SIMULATED MISSILE CARRIERS. THE U.S. NAVY AND U.S. AIR FORCE WOULD BE DIRECTED TO SEARCH FOR, LOCATE, IDENTIFY AND TRAIL-THESE SHIPS, NIGHT AND DAY, FOR AN EXTENDED PERIOD. OPERATING UNDER THE SAME CONDITIONS WHICH WOULD FACE THE RUSSIANS WOULD CLEARLY DEMONSTRATE THE EXTREME DIFFICULTIES ASSOCIATED WITH SUCH TRAILING OPERATIONS.

(B) SEVERAL MX MISSILES SHOULD BE ADAPTED FOR SEA-LAUNCH, BEGINNING IMMEDIATELY, EITHER THROUGH ENCAPSULATION OR WATERPROOFING MODIFICATIONS.. MISSILES WOULD BE TEST-FIRED INTO THE KWAJALEIN IMPACT AREA FROM AN OCEAN LAUNCH SITE. I FEEL CONFIDENT THAT SUCH A TEST FIRING COULD BE ACCOMPLISHED MORE OR LESS CONCURRENTLY WITH THE LAND-BASED MX TESTS PRESENTLY SCHEDULED TWO YEARS FROM NOW.

FOLLOWING THE ABOVE TWO TESTS, SURFACE SHIPS WOULD BE RAPIDLY PHASED IN AS AN INTERIM MX DEPLOYMENT SYSTEM TO BRIDGE THE GAP UNTIL MORE ADVANCED SYSTEMS WERE DEVELOPED. SOME MINUTEMAN SILOS COULD BE RETROFITTED TO ACCEPT MX MISSILES, ALSO AS AN INTERIM MEASURE, IN ORDER TO PRECLUDE THE SEVERE IMPACTS OF THE MX/MPS CONCEPT. EVENTUALLY, WE SHOULD EMBRACE A STRATEGIC DEPLOYMENT WHICH IS MORE HEAVILY, BUT NOT ENTIRELY, WEIGHTED IN FAVOR OF SEA-BASING. WE WOULD MODERNIZE OUR STRATEGIC BOMBER FORCE. WE WOULD CONTINUE THE DEVELOPMENT AND DEPLOYMENT OF CRUISE MISSILES, AND BE AS FLEXIBLE AS POSSIBLE IN THEIR DEPLOYMENT MODES.

IN ADDITION TO SEVERAL PICTORIALS OF THE ELEMENTS OF SEA-BASING, I WOULD LIKE TO DRAW YOUR ATTENTION TO THE EFFECTS OF A FULL-SCALE NUCLEAR ATTACK ON THE UNITED STATES, DRAWN FROM REPORTS BY DR. ROGER SULLIVAN FOR THE FEDERAL EMERGENCY MANAGEMENT AGENCY. HE ESTIMATES THAT WITHOUT CIVIL DEFENSE MEASURES, 130 TO 170 MILLION AMERICANS WOULD BE KILLED. (SEE THE TWO MAPS, WITH TARGET COMPLEXES, AND FOLLOWING THE PRIOD WHEN PREVAILING WINDS CARRY THE FALLOUT EASTWARD.) CERTAINLY, THE ADDITION OF 4600 STRATEGIC BULLSEYE'S WITHIN THE STATES OF UTAH AND NEVADA WILL NOT HELP MATTERS ANY. NOT WHEN THEY COULD BE PLACED AT SEA, WITH A MAJOR PORTION OF

THE FALLOUT DISSIPATED IN THE OCEAN AREAS. WHETHER THE AIR FORCE STRATEGISTS PRESENTLY PROPOSING THE MX/MPS REALIZE IT OR NOT, THEY ARE IN ESSENCE SELECTING ONE OF THE NUCLEAR BATTLEGROUNDS FOR WW III, WITHIN OUR OWN LIVING ROOM. TO ME, THAT IS POOR STRATEGY: I WOULD PREFER TO SEE THE MX MISSILES MOVED OUT TO SEA. IN PEACETIME, UTAH AND NEVADA WOULD BENEFIT. IN THE EVENT OF WAR, IT COULD MEAN THE SURVIVAL OF MILLIONS OF AMERICANS.

POINT PAPER - SEA-BASING MX USING THE FLOATING LAUNCH

Description:	The vertical-floating (or HYDRA) launch technique uses missiles which float either bare (but waterproofed) or encapsulated in a vertical position. Propulsion motor is ignited while in this position, thus using the water as a "free" launch pad. (The Russians use this method for their SLBM missiles, after float-up from the submarine.)
Emplacement:	Many types of ships or other platforms can be used to transport HYDRA-type missiles to the water, or over the water. Missiles can be launched from open ocean, coastal, bay or harbor, or inland lake sites.
Probable Systems:	o Armed merchantmen (containerships) or naval combatants could jettison missiles into the water upon receipt of launch signal. Time from jettison to fire is less than two minutes. o Submarines (including small diesel electric subs) could transport the missiles horizontally (due to their size) and float them to the surface, from whence they would be fired. Again, release to fire time is less than two minutes.
Advantages:	o Lower cost o Avoids environmental impacts (such as MX/MPS incurs) o Removes targets from U.S. mainland o Quicker IOC, FOC (can use existing ships, no massive land facilities) o System Targeting by enemy more obvious and detectable than for land-based system o Constant targeting of moving platforms would involve massive expenditures by enemy o Launch Safety (missiles fired while 100-200 yards astern) o Sunk costs. Ships could revert to merchantmen in event of disarmament or arms limitation treaty. o Unlimited salvo (simultaneous) firepower. (As many missiles as can be floated in the water)
Modifications to MX:	o MX missile as presently designed readily adaptable to water launch. Changes would be needed in guidance section, and structural waterproofing would be required. Otherwise, missile remains same.

ADVANTAGES OF SEA-BASING USING THE FLOATING LAUNCH

- REMOVES U.S. POPULATION AND TERRITORY FROM LINE OF FIRE OF NUCLEAR ATTACK
- RAPID BUILDUP TO IOC AND FOC
- NO ENVIRONMENTAL IMPACT ON LAND OR AT SEA
- MORE ECONOMICAL
- SHIPS CAN REVERT TO MERCHANT FLEET STATUS IN EVENT OF SALT ACCORDS OR DISARMAMENT

MAILGRAM SERVICE CENTER
MIDDLETOWN, VA. 22645

4-067385S153002 06/02/81 ICS IPMMTZZ CSP FCHD
1 7032814489 MGM TDMT VIENNA VA 06-02 0854P EST

CAPTAIN JOHN E DRAIM USN RETIRED
9310 TELFER CT
VIENNA VA 22180

THIS MAILGRAM IS A CONFIRMATION COPY OF THE FOLLOWING MESSAGE:

7032814489 MGM TDMT VIENNA VA 205 06-02 0854P EST
ZIP
KEITH HAINES
UTAH COUNTY REPUBLICAN EXECUTIVE BOARD
787 EAST 300 SOUTH #3
PROVO UT 84601

UNDERSTAND YOU ARE REVIEWING MX BASING ISSUE. CONSEQUENTLY I WOULD LIKE TO GIVE YOU MY PERSONAL VIEWS.

MX-MPS SHELL GAME BASING MODE IN UTAH AND NEVADA DOES NOT IN MY OPINION CONSTITUTE A SOUND STRATEGIC DEPLOYMENT. IF ATTACKED, RADIO ATTIVE FALLOUT WOULD NOT ONLY DECIMATE UTAH AND NEVADA, BUT WOULD RAPIDLY DRIFT OVER THE MOST POPULATED AREAS OF THE UNITED STATES. OTHER, MORE VIABLE, DEPLOYMENTS INCLUDE SEA-BASING MX IN SURFACE SHIPS OR SUBMARINES, OR BOTH. ATTACKER WOULD HAVE TO EXPEND A MAJOR PORTION OF HIS NUCLEAR CAPABILITY ON HARD-TO-FIND AND HARD-TO-KILL MOVING TARGETS REMOVED FROM US POPULATION CENTERS. WARNNG TIME WOULD BE INCREASED WITH SEA-BASING. SURPRISE ATTACKS ALWAYS MOST SUCCESSFUL AGAINST FIXED TARGETS AND THE 4600 SHELTERS WILL ALL BE AT FIXED AND KNOWN LOCAPIONS. TECHNICAL MEANS ARE AVAILABLE FOR DEPLOYING MX AND OTHER ICBM'S AT SEA. STATEGIC ENVIRONMENTAL AND COST FACTORS ALL FAVOR SEA-BASING.

ABOVE VIEWS WERE DISCUSSED AT CONGRESSIONAL RESEARCH SERVICE SEMINAR IN MARCH. CRS MEMBERS WERE CHARGED WITH COLLECTING INFORMATION FOR USE OF THE US SENATE AND HOUSE OF REPRESENTATIVES ON MX ALTERNATIVES.

SINCERELY
THOMAS H MOORER ADMIRAL US NAVY RETIRED 6901 LUPINE LN MCLEAN VA 22101

2059 EST

MAILGRAM SERVICE CENTER
MIDDLETOWN, VA. 22645

4-0201865154002 06/03/81 ICS IPMMTZZ CSP FCHB
1 7035364492 MGM TDMT MCLEAN VA 06-03 1124A EST

W F RABORN
1606 CRESTWOOD LN
MCLEAN VA 22101

THIS MAILGRAM IS A CONFIRMATION COPY OF THE FOLLOWING MESSAGE:

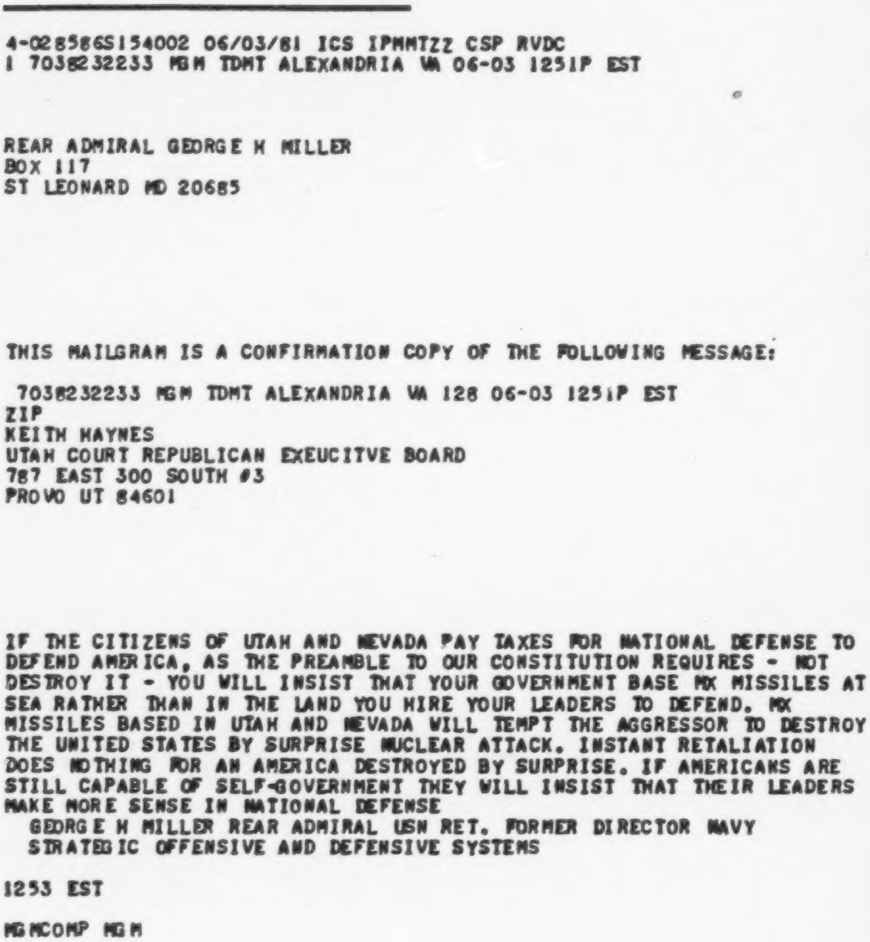
7035364492 NL TDMT MCLEAN VA 152 06-03 1124A EST
PMS KEITH HAINES UTAH COUNTY REPUBLICAN EXECUTIVE BOARD RPT DLY MGM,
6-4-81 9AM, DLR
787 EAST 300 SOUTH #1
PROVO UT 84601

PUTTING A MAJOR PART OF U.S. STRATEGIC WEAPONS IN OUR WESTERN STATES ENDANGERS ALL OF THE U.S.-NUCLEAR SCIENTIST DR. ROGER SULLIVAN CALCULATES 160 MILLION PEOPLE WOULD BE KILLED BY ALL OUT SOVIET NUCLEAR ATTACK ON U.S.-SUCH DOUBLE KILL COULD TEMPT SOVIET ATTACK.-WHAT IS BEST FOR ALL OF U.S. SHOULD STRICTLY GOVERN AND DICTATE OUR CORRECTIVE ACTIONS TO OFFSET SOVIET STRENGTH.-PARTISAN MILITARY AND NATONAL POLITICS AS WELL AS PERSONAL AND REGIONAL ECONOMIC REASONS MUST BE FIRMLY SET ASIDE IF WE ARE TO CONTINUE AS A COUNTRY.-RECOMMEND CONSIDERATION OF "CATCH-UP" AND LONG RANGE PROGRAMS TO CORRECT SITUATION.-INSTALL MX MISSILE IN PRESENT TITAN-MINUTEMAN BASES AT HIGHEST PRIORITY.-SIMULTANEOUSLY PREPARE TEN EXISTING MERCHANT SHIPS TO RECEIVE MX MISSILES FOR LAUNCHING VIA HYDRA METHOD.-ACTIVATE TWO MORE SUBMARINE SHIPYARDS AND BUILD TRIDENT II MISSILE SUBMARINES FOR BASING AROUND WORLD, GUAM ROTA PEARL HOLEYLOCH ETC. FOR LONGTERM 30 YEAR ADDITIONAL DETERRENT FORCE.

VADM W F RABORN USN RET
1606 CRESTWOOD LN
MCLEAN VA 22101

1127 EST

MGMCOMP MGM



4-028586S154002 06/03/81 ICS IPMMTZZ CSP RVDC
1 7038232233 MGM TDMT ALEXANDRIA VA 06-03 1251P EST

REAR ADMIRAL GEORGE H MILLER
BOX 117
ST LEONARD MD 20685

THIS MAILGRAM IS A CONFIRMATION COPY OF THE FOLLOWING MESSAGE:

7038232233 MGM TDMT ALEXANDRIA VA 128 06-03 1251P EST
ZIP
KEITH HAYNES
UTAH COURT REPUBLICAN EXEUCITVE BOARD
787 EAST 300 SOUTH #3
PROVO UT 84601

IF THE CITIZENS OF UTAH AND NEVADA PAY TAXES FOR NATIONAL DEFENSE TO DEFEND AMERICA, AS THE PREAMBLE TO OUR CONSTITUTION REQUIRES - NOT DESTROY IT - YOU WILL INSIST THAT YOUR GOVERNMENT BASE MX MISSILES AT SEA RATHER THAN IN THE LAND YOU HIRE YOUR LEADERS TO DEFEND. MX MISSILES BASED IN UTAH AND NEVADA WILL TEMPT THE AGGRESSOR TO DESTROY THE UNITED STATES BY SURPRISE NUCLEAR ATTACK. INSTANT RETALIATION DOES NOTHING FOR AN AMERICA DESTROYED BY SURPRISE. IF AMERICANS ARE STILL CAPABLE OF SELF-GOVERNMENT THEY WILL INSIST THAT THEIR LEADERS MAKE MORE SENSE IN NATIONAL DEFENSE

GEORGE H MILLER REAR ADMIRAL USN RET. FORMER DIRECTOR NAVY STRATEGIC OFFENSIVE AND DEFENSIVE SYSTEMS

1253 EST

MGMCOMP MGM

4-070201S153002 06/02/81 ICS IPMMTZZ CSP FCHD
1 7037909477 MGM TDMT VIENNA VA 06-02 1038P EST

J ALVIS
8506 QUAINT LN
VIENNA VA 22180

THIS MAILGRAM IS A CONFIRMATION COPY OF THE FOLLOWING MESSAGE:

7037909477 MGM TDMT VIENNA VA 168 06-02 1038P EST
ZIP
KEITH HAINES
787 EAST 300 SOUTH 3
PROVO UT 84601

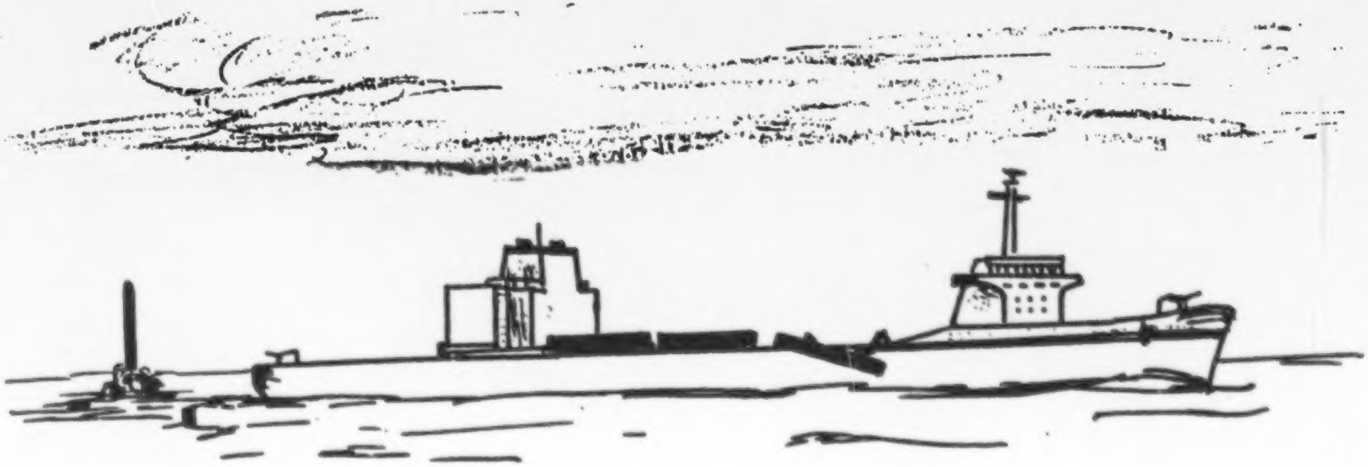
I BELIEVE YOU ARE INVOLVED IN A REVIEW OF THE MX MISSILE BASING PLAN. IT IS MY OPINION THAT THE SEA BASED ALTERNATIVES HAVE NOT BEEN GIVEN AN IMPARTIAL REVIEW. WE NEED THE MX MISSILE AND WE NEED IT QUICKLY BUT THE MPS SHELL GAMES AND THE SCAR IT WILL LEAVE ON THE WESTER U S, EVEN IF THERE IS NO NUCLEAR EXCHANGE, MAKES NO SENSE. IT IS TECHNICALLY FEASIBLE TO DEPLOY THESE MISSILES AT SEA. THE ARGUMENTS AGAINST SHIP OR SUBMARINE BASING HAVE BEEN ACCEPTED WITHOUT CRITICAL REVIEW BY THOSE COMMITTED TO LAND BASING. THE PROBLEM-OF-PUTTING THE MX TO SEA IS NOT TECHNICAL BUT RATHER THE VERY PRACTICAL PROBLEM OF STOPPING THE MOMENTTUM OF A LARGE GROUP OF CONTRACTORS SIGNED ON TO SUPPORT LAND BASING. I WISH YOU SUCCESS IN YOUR EFFORTS. I BELIEVE AN IMPARTIAL REVIEW OF MX BASING WILL DIVERT THIS VITAL WEAPONS SYSTEM TO SEA

JOHN H ALVIS REAR ADMIRAL USN RETIRED

2242 EST

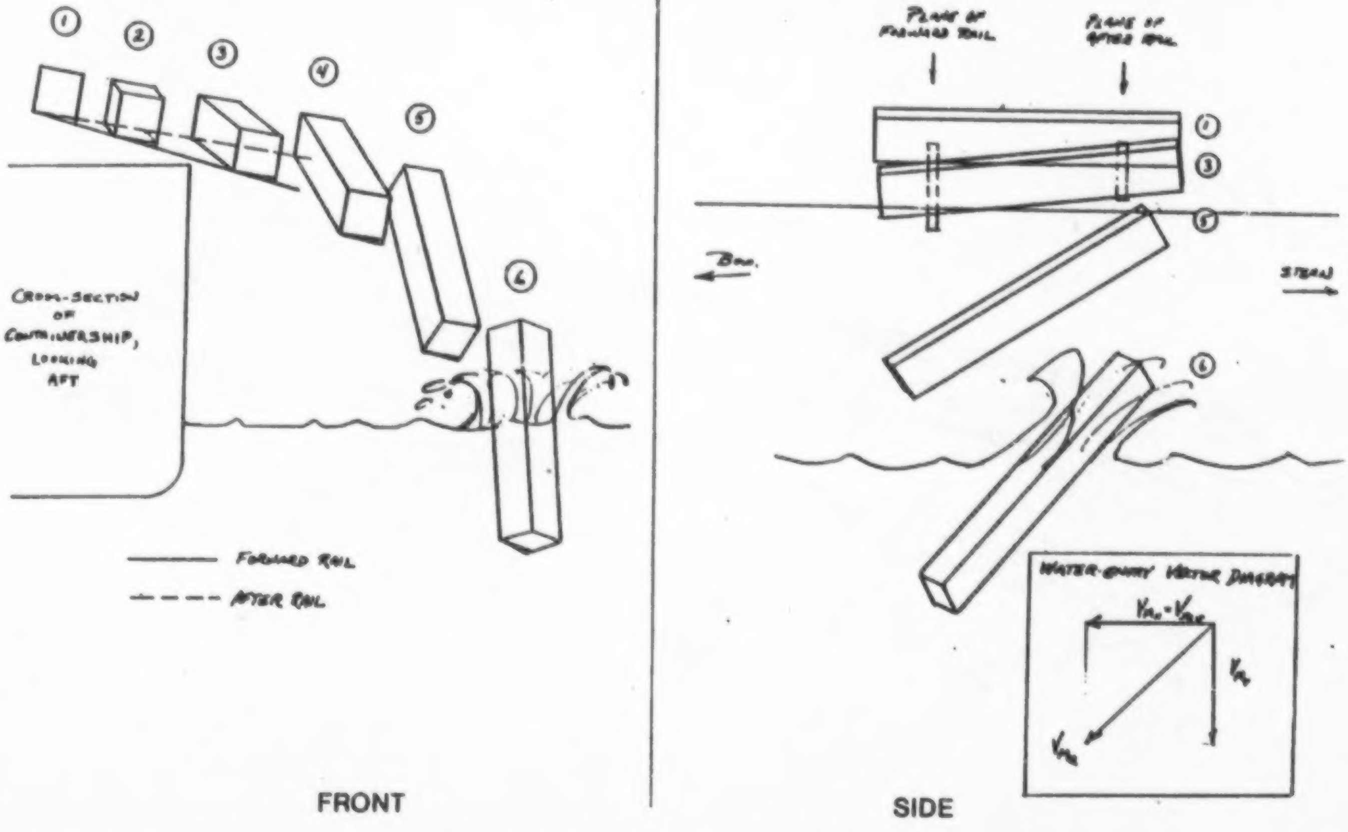
MGMCOMP MGM

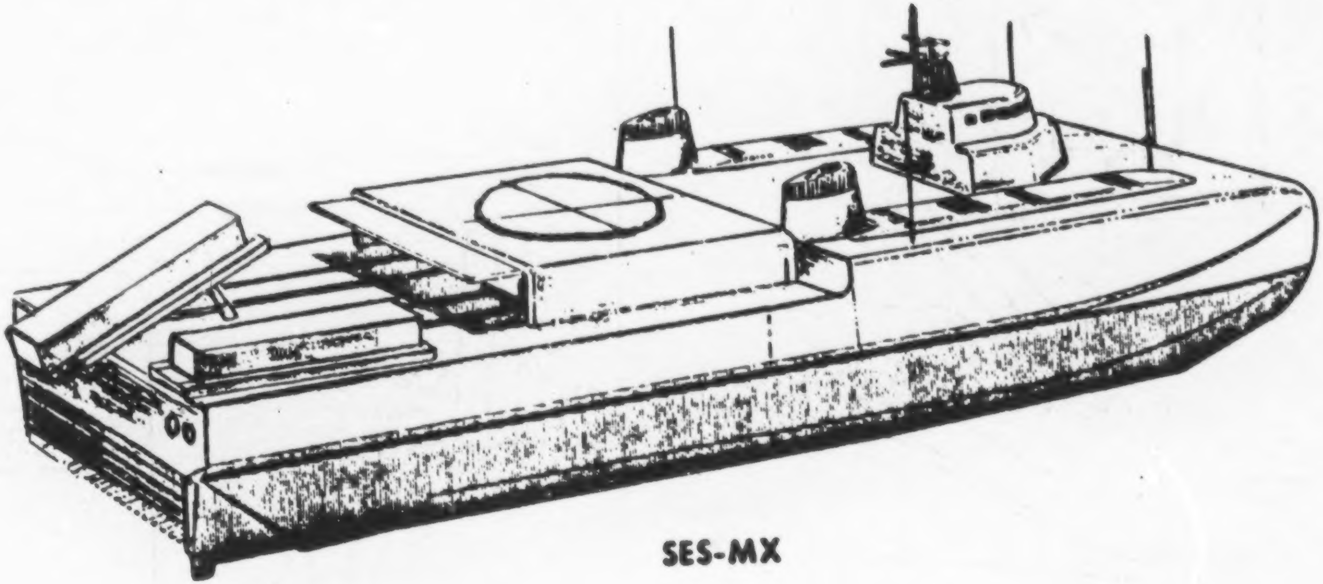
NEAR-TERM MX SHIP



● DESIGN:	SEA-LAND SL-7
● SPEED:	33-35KNOTS
● LENGTH:	946 FT.
● DRAFT:	30 FT.
● DISPLACEMENT:	43,000 TONS
● PROPULSION:	120,000 SHP TWIN-SCREW TWIN-TURBINE
● CREW:	200 (INCLUDES MISSILE CREW)

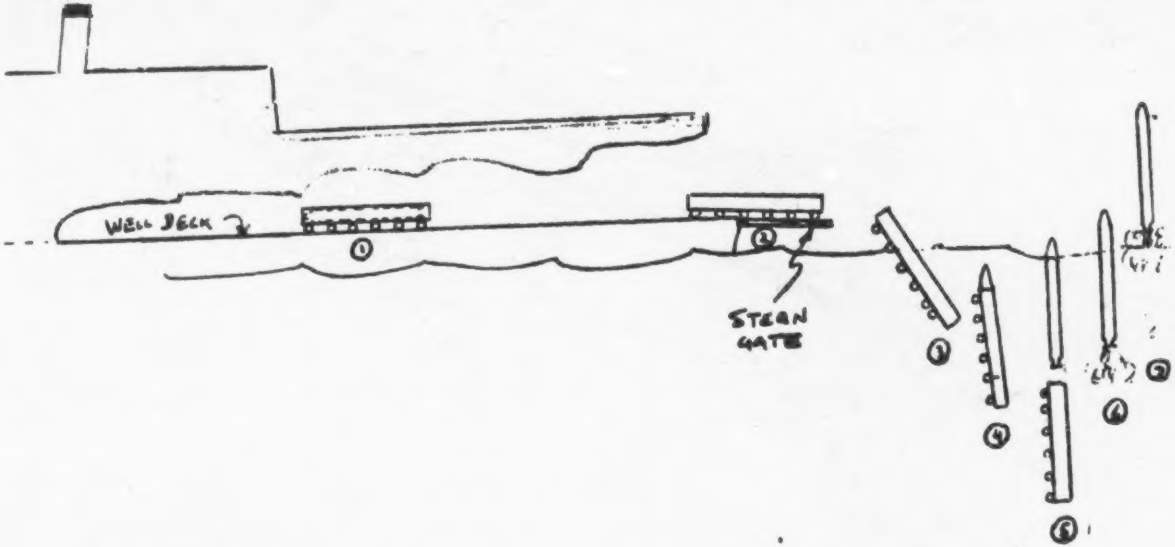
FRONT AND SIDE VIEWS OF MISSILE CANNISTER JETTISON


①
②
③
④
⑤
⑥
CROSS-SECTION OF CONTAINERSHIP, LOOKING AFT
FORWARD RAIL
AFTER RAIL
FRONT
PLANE OF FORWARD RAIL
PLANE OF AFTER RAIL
①
③
⑤
⑥
BOW
STERN
WATER-ENTRY VECTOR DIAGRAM
SIDE

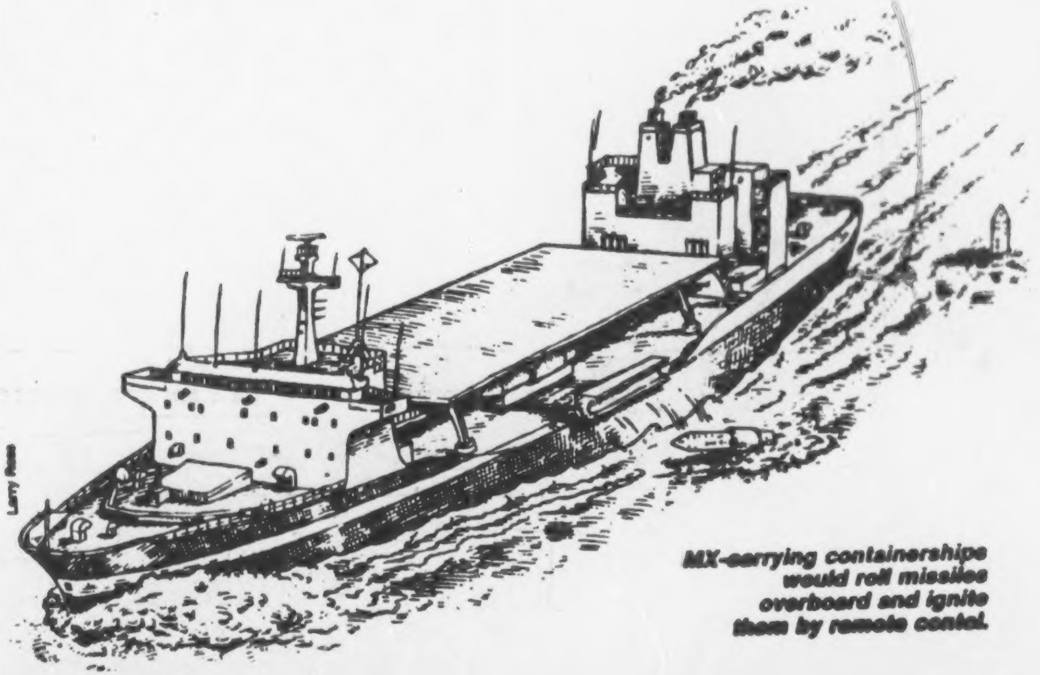


SES-MX

"Capsule-Slide" Method of Jettison

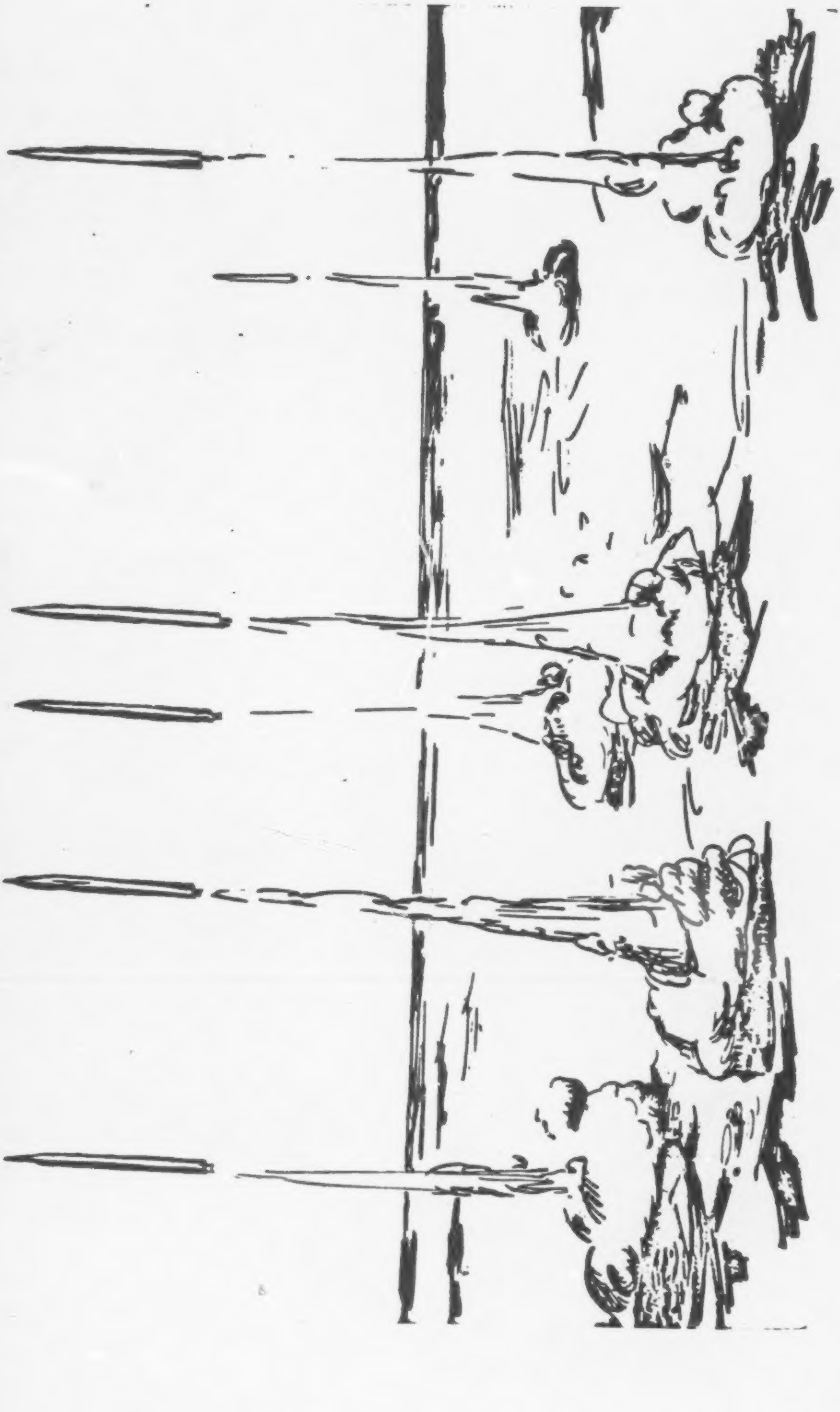

WELL DECK
①
②
STERN GATE
③
④
⑤
⑥
⑦

Well-Deck Jettison from LSD, LPD, LST Ships

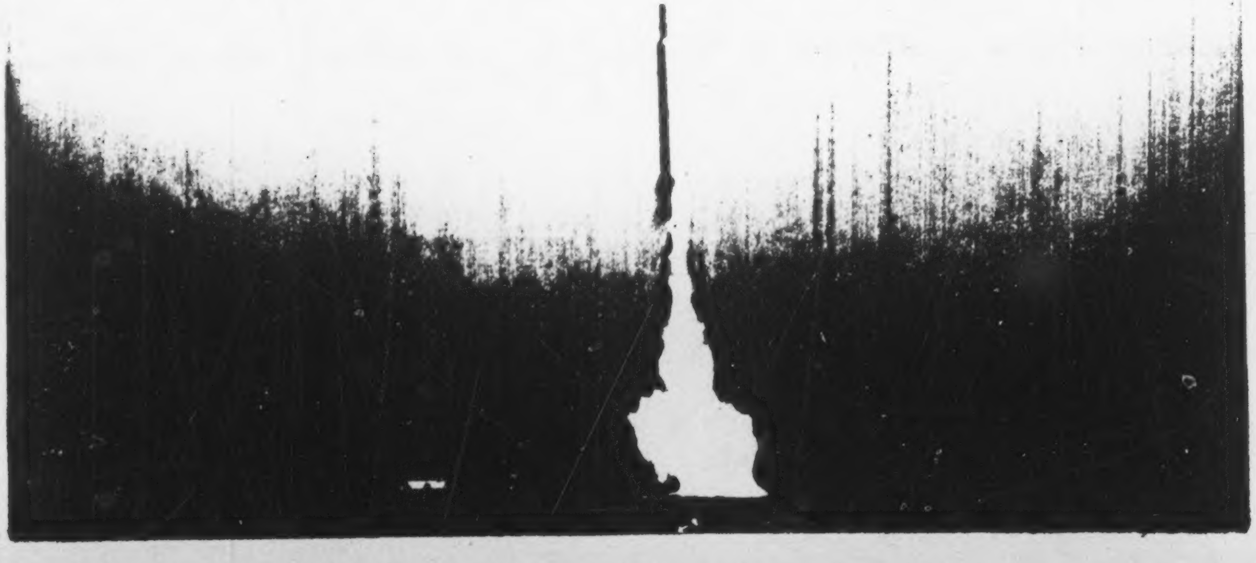


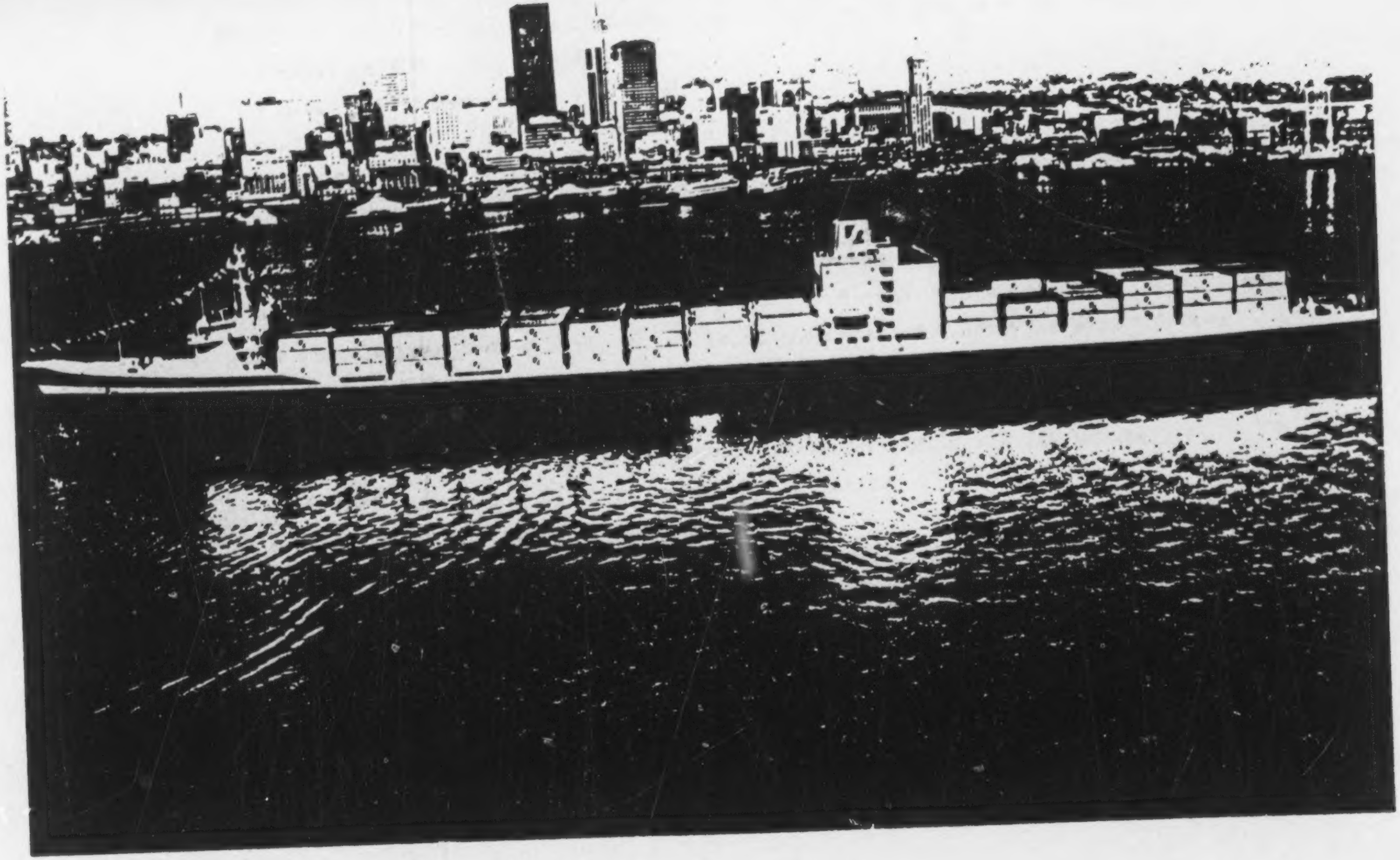
Larry Ross

MX-carrying containerships would roll missiles overboard and ignite them by remote control.



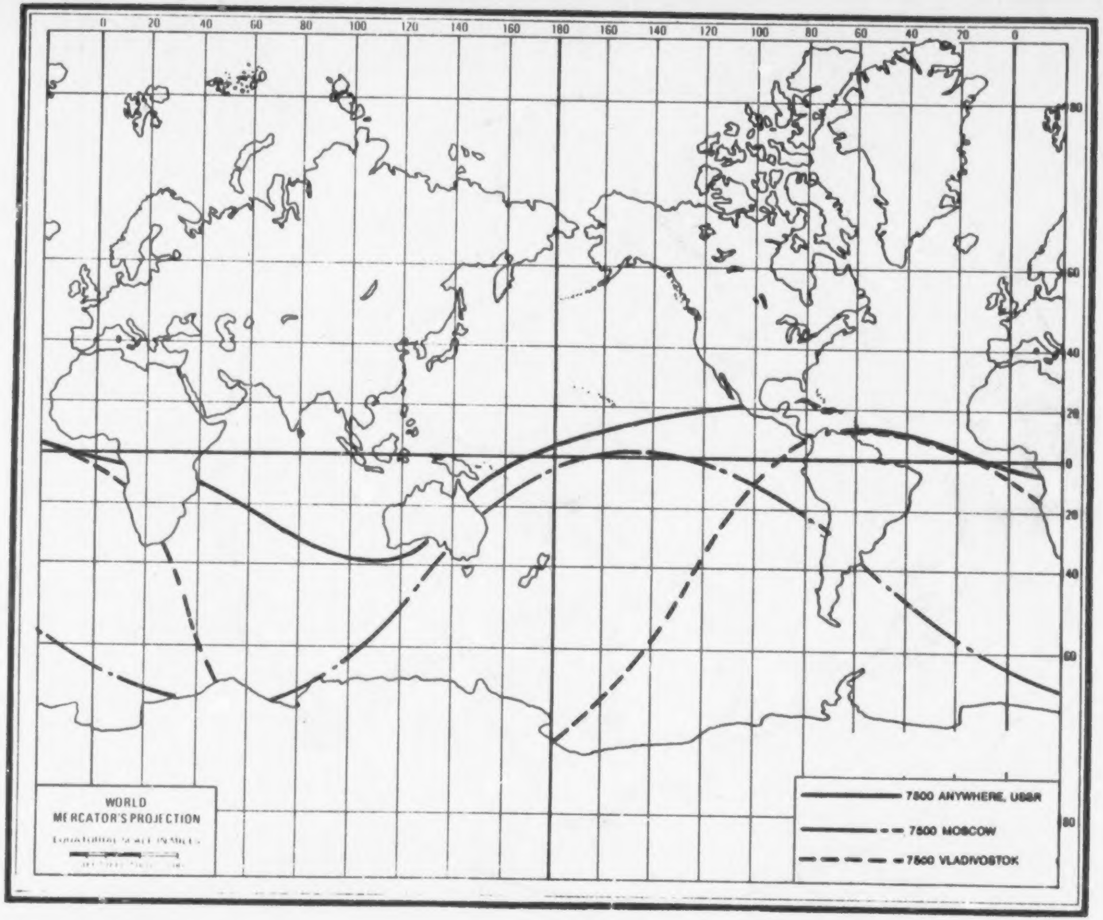
HYDRA II Launch off Pt. Mugu, Calif.
23 September, 1960 supported by amphibious
DUKW truck. HYDRA II is 44' long, T/W=1.8
Weight 10 tons

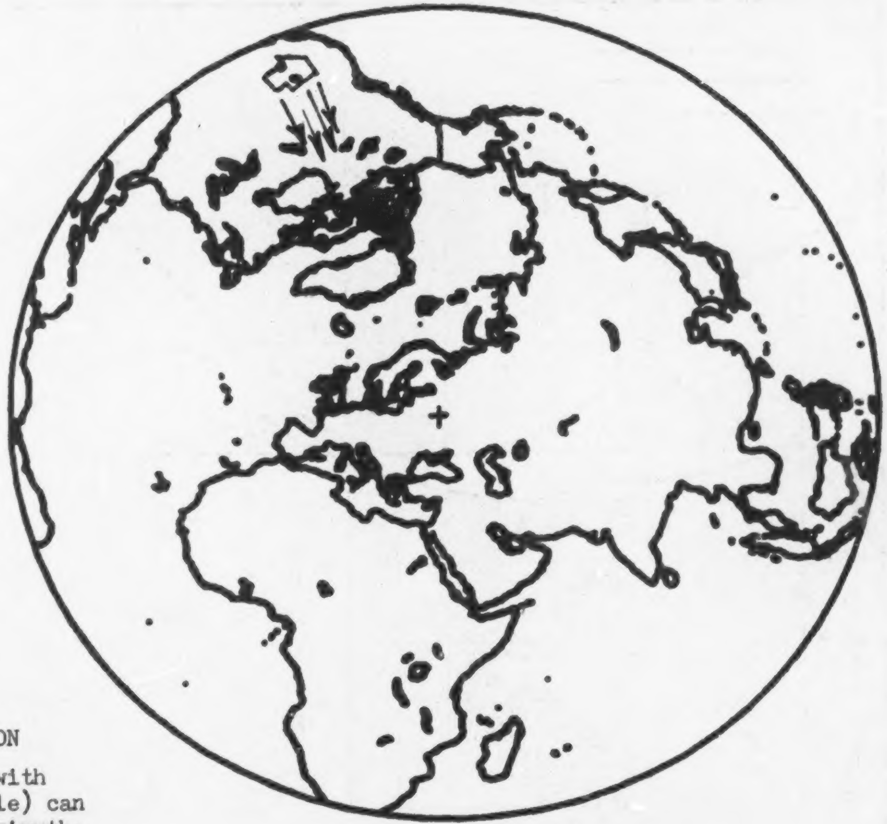




PROJECT HYDRA ACCOMPLISHMENTS - 1960-1965

- o Over fifty (50) floating launch rockets successfully launched
- o HYDRA rockets have been launched in both Atlantic and Pacific Oceans and at the equator
- o HYDRA rockets launched have ranged from 5 ft. to 40 ft. in length; 50 lbs to 20,000 lbs in wt.
- o HYDRA rockets have been launched using firing signal from electrical cable, R/C, and timer
- o Over 100 technical reports have been written on floating launch techniques
- o HYDRA rockets have been dropped overboard and launched from following type ships:
  - Seaplane Tender (USS Norton Sound)
  - Landing Ship Dock (USS Alamo and USS Point Defiance)
  - Range/Instrumentation Ships- Merchant Conversion (Richfield and Huntsville)
  - River Tug Boat 'S' Class #T-440
  - Yard Ferry Class YTF
- o HYDRA rockets have been dropped in the water from piers and seaplane beaching gear
- ● HYDRA rockets have been dragged off the beach using USMC amphibious tanks (LVT-3), warping tug
- ● In the floating position HYDRA rockets have been towed by LVT-3s, whaleboats, rearming boats, tug boats, DUKWs, inflatable rubber boats, LCMs, Landing Ship Dock
- ● HYDRA rockets have been recovered and re-launched
  - HYDRA I (Solid Fuel)
  - HYDRA II (Solid Fuel)
  - HYDRA Demonstrator (Solid Fuel)
  - HYDRA SEABEE (Liquid Fuel)
- o On 26 Jan 1965, a HYDRA-IRIS launched 1000 miles east of Buenos Aires carried 125 pound scientific instrument payload to altitude of 285 km. Successful in all respects

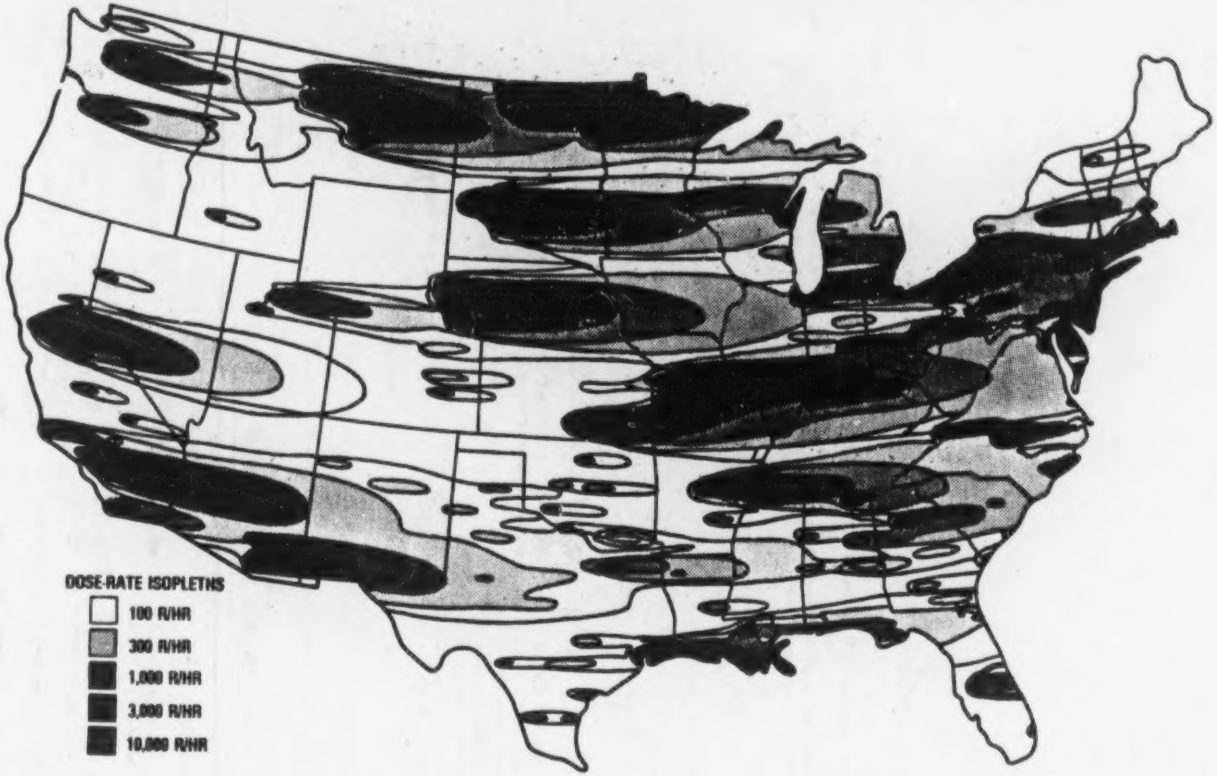

0
20
40
60
80
100
120
140
160
180
160
140
120
100
80
60
40
20
0
80
60
40
20
0
20
40
60
80
WORLD
MERCATOR'S PROJECTION
EQUATORIAL SCALE IN MILES
7500 ANYWHERE, USSR
7500 MOSCOW
7500 VLADIVOSTOK



AZIMUTHAL EQUIDISTANT PROJECTION

Showing that sea-based ICBM's with range of 5400 n.m. (outer circle) can attack Moscow, USSR from any azimuth: ICBM's in Utah/Nevada approach only in a narrow corridor of a few degrees.

UNIT TIME REFERENCE DOSE RATES FOR THE U.S.


DOSE-RATE ISOPLETHS
100 R/HR
300 R/HR
1,000 R/HR
3,000 R/HR
10,000 R/HR

BIOGRAPHICAL SKETCH

JOHN E. DRAIM, CAPT., USN (RET.)

JOHN E. DRAIM
CAPTAIN, USN (RET.)

SYSTEMS ENGINEER/WEAPONS & SPACE SYSTEMS

Education

E.A.A., Aeronautical/Astronautical Engineer, 1969	Massachusetts Institute of Technology
Graduate, 1965	Armed Forces Staff College
M.S., Aeronautical Engineering, 1956	Massachusetts Institute of Technology
B.S., Aeronautical Engineering, 1955	U.S. Naval Postgraduate School
B.S., Naval Science, 1949	U.S. Naval Academy, graduated with distinction

Employment

Defense Industry		1972-Pres	Technical Staff/ Project Engineer
U.S. Navy	1949-1972	1949-1972	(Captain, USN, '69-'72) Naval Aviator, Jet Fighter & Attack Squadro

Professional Affiliations, Citations, and Patents

Meritorious Service Award (USAF) for contributions to Space Program
American Institute of Aeronautics and Astronautics
American Security Council
American Society of Sigma Xi
U.S. Naval Institute
American Defense Preparedness Association
Nine U.S. Patents in field of floating launch rockets and EVA/rocket attitude control

Professional Experience

- Currently conducting studies in Space Defense and Space Support systems
- Provide technical support to Air Force Advanced Space Communications Planning
- Director of Programs Division (SP-7), Office of the Assistant Secretary of the Air Force Space Systems, (SAFSS) (1971-1972).
- Deputy Director of Navy Space Programs, OP-76B, Office of the Chief of Naval Operations. Officer-in-Charge, Navy Space Projects Activity (1969-1971).
- Director, Astronautics Research Division, U.S. Navy Missile Center, Point Mugu, California (1960-1962).
- Program Manager, Project HYDRA, (Vertical Floating Launch Rocket Project), Point Mugu, California (1959-1962).
- Deputy Director, Navy Armaments Division, USNATO, Paris, France (1965-1967).
- Conducted Analysis of Soviet SLBM Systems
- Prepared Mission Analysis and Program Evaluation for AF Armament Test Laboratory on application of NAVSTAR GPS to Tactical Missile Guidance (TGPSG).
- Designed and subcontracted for fabrication two patented experimental spinning plug nozzles, which are currently undergoing tests at Redstone Arsenal.

CONCLUSION OF HEARINGS

The subcommittees will stand in recess, subject to the call of the Chair.

[Whereupon, at 11:55 a.m., Friday, June 19, the herings were concluded and the subcommittees were recessed to reconvene at the call of the Chair.]

LIST OF WITNESSES, COMMUNICATIONS, AND PREPARED STATEMENTS

Page
Alessi, Victor E., U.S. Arms Control and Disarmament Agency 55

Bras, Maj. Victor D., Advanced ICBM System Staff Officer, Special Assistant for MX, Deputy Chief of Staff, Research, Development, and Acquisition 23, 225
Burke, Lt. Gen. Kelly H., Deputy Chief of Staff, Research, Development, and Acquisition, Department of the Air Force 23, 145

Carpenter, Lee, Prompt Counterforce, Disruptive ABM and Road Mobile Reserve 211
Carter, Ashton, MX Project Staff, Office of Technology Assessment 93

Davis, William A., Jr., Deputy Program Manager, Ballistic Missile Defense, Program Office, Department of the Army 177
Draim, Capt. John E., USN (Ret.), Former Navy Research and Development Manager 291
  Biographical sketch 324
  Prepared statement 303
Drell, Sidney D., Deputy Director, Stanford Linear Accelerator Center, Stanford University 264
  Biographical sketch 263
  Prepared statement 234

Fairbourn, Maj. Gen. W. T., U.S. Marine Corps (Ret.), prepared statement 286
Frank, Forrest, MX Project Staff, Office of Technology Assessment 93

Garn, Hon. Jake, U.S. Senator from Utah, prepared statement 2
Gibbons, John H., Director, Office of Technology Assessment 93, 147
Graham, Thomas, Jr., General Counsel, U.S. Arms Control and Disarmament Agency 55
Graybill, Maj. Donald J., Directorate of Engineering and Services, Deputy Chief of Staff, Logistics and Engineering 23

Johns, Lionel S., Assistant Director, Office of Technology Assessment Energy, Materials, and International Security Division 93

Kalish, Jack, Director, Ballistic Missile Defense Program, Department of the Army 177

Laxalt, Hon. Paul, U.S. Senator from Nevada, prepared statement 2

Markey, Maj. Jefferey H., Directorate of Engineering and Services, Deputy Chief of Staff, Logistics and Engineering 23
McCarthy, Brig. Gen. James P., Special Assistant for MX, Deputy Chief of Staff, Research, Development, and Acquisition, U.S. Air Force 23, 69
Messing, Marc, MX Project Staff, Office of Technology Assessment 93
Miller, James R., Chief, Weapons and Systems Division, Defense Intelligence Agency 5
Montulli, Lt. Col. Louis T., Advanced ICBM System Staff Scientist, Special Assistant for MX, Deputy Chief of Staff, Research, Development, and Acquisition 23, 224

Postol, Theodore, MX Project Staff, Office of Technology Assessment 93

Page
Roth, Hon. William V., U.S. Senator from Delaware 35
Prepared statement 37
Rowny, Lt. Gen. Edward L. (Ret.), Consultant, U.S. Arms Control and Disarmament Agency 55

Schmitt, Hon. Harrison, U.S. Senator from New Mexico 35
Prepared statement 43
Sharfman, Peter, Program Manager for International Security and Commerce, Office of Technology Assessment 93
Staffin, Robin, MX Project Staff, Office of Technology Assessment 93

Watson, Lt. Col. Samuel J., Special Assistant, U.S. Arms Control and Disarmament Agency 55
Wright, Brig. Gen. Clifton D., Deputy Director of Engineering and Services, Deputy Chief of Staff, Logistics and Engineering 23

SUBJECT INDEX

Page

- ABM–MPS system:
  - Baseline terminal defense, 179, 185, 197
  - Bean counting system, 195
  - Combined system deployment, 198
  - Destabilizing effect of, 207
  - Disruptive mode, 165
  - Exoatmospheric defense, 151, 182, 188, 204, 270, 299
  - Grand Forks, N. Dak. site, reuse of, 201
  - Layered defense, 184, 197
  - Low altitude defense applications, 194
  - Low altitude defense system (LoADS), 99, 116, 141, 167, 181, 187, 192, 270
  - Mobile deployment, 59
  - Nonmobile site defense systems, 200
  - Overview, 178
  - Problems associated with, 101
  - Research and development, 278
  - Safeguard system comparisons, 199, 223
  - Satisfactory alliance of, 25
  - Site defense system, 200, 203
  - Stability assessment, 198
- ABM treaty:
  - Discussions toward, 230
  - Review of, 61
  - Soviet violations of, 62
  - Status of, 50
  - Weaknesses of, 51
- Aircraft-mounted missiles, 174
- Air-mobile MX (*See also* MX–MPS basing), 101, 127
- B–1 bomber, effect of MX decisions on, 91
- Balanced budget target, chart on, 47
- Basing systems:
  - Acquisition and operation costs through year 2000, chart on, 285
  - Survivability, 169, 220
- CEP potential and improvement, 14, 222
- Command and control, post-attack efficiency of, 274
- Counterforce capability, 67
- Counterforce warfare, 216
- Cruise missile, use of as first strike weapon, 22
- Damage expectancy, 6
- Deterrence theory, 229
- Early warning system, enhancement of, 203
- Europe:
  - Land-based missile systems in, 269
  - Operational environment in, 227
- Exchange ratios, drawdown chart on, 26
- Exo-atmospheric defense theory (*See* ABM–MPS system.)
- Favorable exchange ratio, 25
- Force endurance after initial attack, 170
- Force structure analysis, 215
- Highway mobile missile system, 226
- Hydra–MX (*See* Surface ship basing.)

ICBM (*See also* U.S.S.R.): Page
  ABM protection of 22, 221
  Accuracy of 13
  Confirmed tactical warning, launch on 219
  Effectiveness of 214
  Improvement trends in 13
  Minuteman missile system:
    Adding MX missile to 52
    MPS deployment of 118
    Self defense of 223
    Soviet missile capability against 9, 11
    Status 268
    Upgrading of 213
    Use of dummy holes for 88
    Vulnerability of 10, 11, 269
  Mobile system 232
  New and modified versions, projection of 13
  Prelaunch force security 221
  U.S./U.S.S.R. comparisons 219
Intelligence community information, accuracy of 17
Laser programs 45, 151
Launch-on-warning/launch-under-attack, description of 85, 120, 142, 160, 167
Launches, satellite detection of 86
LoADS defense system (*See* ABM–MPS system.)
Minuteman missile (*See* ICBM.)
Multiple shelter theory 224
Mutual assured destruction (MAD) theory 3, 38, 41, 43
MX missile system:
  Characteristics 105
  European theater, deployment in 53
  First strike capability 84
  National policy on 161
  Program status 69
  Railroad use for 154
  Verifiability of 57
MX–MPS basing system:
  Acceptable and unacceptable basing modes 129
  Aim point costs 79
  Alternatives to 35, 83, 162
  Based load 196
  Baseline system 92, 103
  Basing area selection 81, 116
  Cluster layout 70, 104, 114
  Comparisons 129, 168
  Cost to local governments 72, 140
  Currently proposed situation 222
  Deployment scheme 212, 253
  Design and modification of 24, 64
  Feasible examples for 97, 157
  Implications of 40, 55
  Inflationary rates for 76
  Jamming problems 82
  Kirkland AFB, use of 79
  Legality of, under SALT II treaty 56
  Life cycle cost estimates, chart on 159
  Minimal deployment 152
  Per shelter costs 79
  Prelaunch survivability 217
  Preservation of Location Uncertainty (PLU) 99, 102, 106, 166
  Principal drawbacks of 98, 155, 215, 235
  Program status 73

MX-MPS basing system—Continued Page
    Proposed deployment 16, 32
    Proposed operating bases 83
    R.D.T. & E. total costs 75, 112, 135, 157
    Regional impacts of 110, 140, 281, 282
    Schedule for 81, 136
    Shelter construction 70, 74, 99, 107
    Site development 77, 281
    Soviet air threat to 6, 8, 32
    Soviet opposition to 57, 63
    Survivability, charts on 252, 261
    Test programs for 78
    Traffic control for 71, 72
    Train branch line alternative 156
    Transporter 73
    Vertical shelters 113
    Vulnerability of 20
NAVSTAR program funding 280
No-SALT high threats 33
North Dakota sites 154
Office of Technology Assessment, study by 96
Phased array radar battle management 62
Postattack options 218
Reentry vehicles 18
Risk options, criterion determining:
    Arms control considerations 171
    Command, control, and communications 171
    Endurance after attack 170
    Impacts on physical environment 172
    Institutional constraints 172
    MPS system 171
    Stability 173
    Survivability 169
    Technical risk 169
    Weapon effectiveness 171
Road construction costs and requirements 153, 155
SALT II treaty:
    Accomplishments, lack of 52
    Opposition to 282
    Soviet compliance with 17
    Violations 60, 301
Sea-based missile system (*See* Submarine force.)
Selected program acceleration, chart on 48
Silos:
    ABM defense of 205
    Air mobile and ABM defense of 151
    Basing of MX missiles in 39, 121
    Hardness of 164, 188
    Laser defense of 151
    SALT, effect from 150
    Soviet increased use of 90
    Targeting against 12
    Vulnerability of Soviet warheads in 27
Single shot kill probability 6, 11
SLBM/SSBN force 7
SOFAS system (*See also* MX-MPS basing) 88, 191
Strategic forces:
    Independent study on 211
    Study methodology, chart on 212
    Survivability of 56

Page

- Submarine force:
  - Barraging and breakthrough 267
  - Boat sizes 265
  - C^3 submarine 163
  - Capability of Soviet missiles to destroy 30
  - Crewmen, motivation and retention of 276
  - Durability 275
  - Effect on future arms control talks 280
  - Endurance factors 276
  - Kill rating 268
  - Missile basing on 122, 143, 148, 164, 279
  - Missile costs of 266
  - Missile survivability on 100, 148, 238
  - Missiles, verification of 58
  - Obsolescence 283
  - Oceanic acoustics 265
  - Sea-based strategy 291
  - Security of sea-based system 228
  - Shipyard capability 272, 277
  - SUM concept 149, 234, 239, 242, 249, 255, 264, 266, 271, 277
  - Survivability 273
  - TRIDENT boat 150
- Surface ship basing:
  - Crew manpower problems 295
  - Defense of 293
  - Hydra-MX, deployment of floating-launch missiles 303
    - Advantages 307
    - Charts relating to 312–323
  - Hydralaunch problems 294
  - Mobility 126
  - SL–7 surface ship capabilities 292, 297
  - Survivability 292, 293
  - Vulnerability of 292
- Surface ship mobile (*See* Surface ship basing.)
- Target structure 218
- Technology improvement 87
- TRIAD aerodynamic weapons system 5, 230
  - Capabilities 217
  - Continuation of 299
  - Elements in 6
- U.S.S.R.:
  - ABM, Soviet projection of 21, 206
  - Capabilities, evaluation of 212
  - Counterforce capabilities 219
  - Hard and soft assets, protection of 66
  - ICBM force, strength of 8
    - Capability by 1990 16
    - Throw weights 14
  - Land-based missile system, U.S. threat to 19
  - MARV threat by 204
  - Megatonnage 215
  - Missile costs, comparison with U.S 28, 162
  - Missile policy 145
  - Missile production and deployment 15, 21, 225
  - Nonacoustical R. & D. work 270
  - Reentry vehicles buildup 18
  - SS–19, conversion of SS–11 into 65
  - SS–NX–20 system 7
  - Strategic forces, outlays for 29, 161
  - Strategic offensive threat, DIA assessment of 5
  - Strike threat, credibility of 12, 43

Page

U.S.S.R.—Continued
  Submarine detection technology 264
  Submarine-launched ballistic missile force 7
  TRIAD force 31
Weapon systems evaluation 44
Window of vulnerability, strategic missile force facing 37

○